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Buffalo River Watershed Project
Amherst County, Virginia

FINAL ENVIRONMENTAL STATEMENT

Kenneth E. Grant, Administrator
Soil Conservation Service

Sponsoring Local Organizations

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Amherst County, Virginia
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October 1973

PREPARED BY

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Washington, D. C. 20250

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Amherst County

Virginia

Prepared in accordance with
Sec. 102(2) (C) of P. L. 91-190

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IV. Description of Action

A project for watershed protection, flood prevention, and municipal water storage in Amherst County, Virginia, to be implemented under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended.

V. Summary of Environmental Impact and Adverse Environmental Effects

Floodwater and sediment damages in the watershed will be reduced about 88 percent. Sediment entering the James River channel will be reduced about 22,000 tons annually. Conditions allowing more efficient and effective use of 750 acres of flood plain land will be provided. Municipal and industrial water storage will be a major segment of a county-wide water system to serve an estimated 48,000 people. Fish and wildlife habitat improvement will provide improved recreational opportunities for 36,500 people annually. Danger from loss of life due to floodwater will be greatly reduced. Four hundred fifty-four acres of rural land will be changed to dams, spillways, and reservoirs. Agricultural use on about 290 acres will be intermittently interrupted by floodwaters. About 5 miles of potential stream fishery will be inundated.

VI. Alternatives

A. Accelerated Land Treatment Only
B. Land Treatment and Channel Work
C. Land Treatment and Single-Purpose Water Supply
D. Land Treatment, Single-Purpose Water Supply Structure and Flood Plain Zoning
E. Land Treatment With Acquisition and Less Intensive Use of Flood Plain Lands
F. Land Treatment and Flood Plain Zoning, Floodproofing and Flood Warning
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VII. Agencies from which comments have been received

A. Governor of Virginia
B. Department of the Army
C. Department of the Interior
D. Department of Health, Education and Welfare
E. Department of Commerce
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H. Virginia Division of Planning and Community Affairs

VIII. Final Statement transmitted to Council on Environmental Quality on December 26, 1973.

Draft Statement received by Council on Environmental Quality on February 8, 1973.

USDA SOIL CONSERVATION SERVICE ENVIRONMENTAL STATEMENT

Title of Statement: Buffalo River Watershed Project
Amherst County, Virginia

Type of Statement: Final

Date: October 1973

Type of Action: Administrative

Statement:

1. Description

Authority for Project: Federal assistance through P. L. 566, 83d Congress, 68 Stat. 666, as amended.

Sponsoring Local Organizations: Robert E. Lee Soil and Water Conservation District, Amherst County Board of Supervisors.

Purpose of Project: Watershed protection, flood prevention, and municipal and industrial water supply.

Project Measures: The project proposes conservation land treatment measures, two single-purpose floodwater retarding structures and two multiple-purpose structures for storage of floodwater, sediment, and municipal water supply.

Environmental Setting:

Physical Data - The proposed Buffalo River watershed project is all in Amherst County, Virginia, and includes the upper 60,500[1/] acres of the Buffalo River drainage. The downstream end of the proposed watershed project is at the Southern Railway crossing about 12 miles upstream from the confluence of the Buffalo River and the

1/ All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigation by the Soil Conservation Service, U.S. Department of Agriculture.

Tye River. Part of the town of Amherst, county seat of Amherst County, is located in the downstream area of the watershed. Lynchburg, about 20 miles to the south, is the nearest large urban center. Roanoke, Richmond, and Danville, Virginia are within 100 miles. Other metropolitan centers within 200 miles include Norfolk and Bristol, Virginia; Raleigh, Durham, Greensboro, Winston-Salem, and Charlotte, North Carolina; Charleston and Huntington, West Virginia; Washington, D.C. and Baltimore, Maryland. These centers are easily accessible and provide markets and distribution centers for agricultural and manufactured products produced in the watershed.

The headwaters of the Buffalo River originate in the steep ridges of the eastern slope of the Blue Ridge Mountains in central Virginia and extend downstream to the Southern Railway. The watershed, irregular trapezoidal in shape, is about 22 miles long and ranges from about 5 miles wide in the headwaters to about 11 miles wide in the downstream area. It is a tributary of the James River.

There are three major upland soil associations of importance in the Buffalo River watershed.

The Porters, Brandywine and Stony land association is found in the extreme northern part and represents about 20 percent of the watershed. This is a mountainous area of moderately deep to shallow soils. They have been developed mostly from granites, gneisses, schists, diorites, and some greenstone, and are mostly in forest land.

The Porters, Hayesville association comprises about 30 percent of the western and north central area and currently is mostly in forest land. These are moderately shallow to deep well drained soils. Located on mountain and foothill slopes, with moderate natural fertility, they respond well to fertilization and improved management practices.

The Rabun, Wilkes, Hayesville, Dyke soil association covers the largest part of the watershed and represents nearly half of the area. These are reddish brown to brown loam soils. Rabun and Wilkes soils have formed from the weathering of hornblendes, diorites, granites, gneisses, and schists; Hayesville from granites, gneisses, and schists. Dyke is a transported soil that developed mainly from greenstone. These are moderately fertile upland soils which respond well to improved management.

There are about 2,843 acres of flood plain land in the Buffalo River watershed project area. These flood plain soils are the most fertile soils in the watershed. Even though they represent a relatively small portion of the total watershed, they are highly important to each landowner. Quite often they represent all, or most, of the tillable land

and are used for cultivated crops in spite of the flood hazard. About 80 percent of the flood plain soils are the well drained Congaree and State. Chewacla and Wehadkee make up the remaining 20 percent and are somewhat poorly drained.

The area drained by the Buffalo River is underlain by igneous and metamorphic rocks of Precambrian age.1/ The upper 90 percent is underlain by the Blue Ridge complex which includes granites, gneisses, anorthosite, syenite, granodiorite, diorite, and monzonite. The formations present,which are included in the Blue Ridge complex,are the Pedlar, Marshall, and Roseland anorthosite. The lower 10 percent is included in the Lynchburg formation which are metamorphosed sediments such as phyllite, graywacke,and conglomerate.

The Blue Ridge 2/complex formations are jumbled and in many places it is difficult to tell which formation is actually present, particularly in the Pedlar, Marshall, and the Reusens migmatite which probably is also present. Many of the outcrops are deeply weathered and a deep mantle of residuum is present except along the streams where hard bedrock is found in many places.

A quarry was developed and used during the construction of local sections of U.S. Highway 60. It has not been used as a source of materials since that time. There are no other known quarry operations in the watershed.

The water table is generally encountered within 60 feet of ground surface. Shallow wells may furnish small supplies sufficient for domestic use but are susceptible to contamination and irregular periods of decreased yield. Drilled bedrock wells generally yield less than 10 gallons per minute which may be sufficient for domestic use but occasional dry holes are drilled. The quality of water from properly constructed drilled wells is good in most localities.

The topography of the watershed varies widely from very steep in the headwaters ridges to moderately steep in the downstream portion. Elevations range from about 4,100 feet above sea level along the ridge tops in the headwaters to 504 feet in the stream at the downstream end of the watershed.

Land cover conditions in the Buffalo River watershed vary from poor to very good, and have improved in recent years due to emphasis on

1/ Geologic Map of Virginia, DMR 1963.
2/ Geology and Mineral Resources of the Lynchburg Quadrange, Virginia, Bul. 74, VDMR, Brown, W. R., 1958.

livestock operations. Some areas remain which are in need of special attention for conservation measures. Approximately 74 percent of the watershed is in forest land, 2 percent in urban and built up areas in and around the town of Amherst, with the remaining 24 percent open agricultural areas. About 6,560 acres of the George Washington National Forest, managed by the U.S. Forest Service, is located in the watershed. The remainder of the land is in private ownership. Hardwoods occupy 62 percent of the forested area with mixed stands of hardwoods and softwoods occupying 24 percent and softwood stands occupying 14 percent. The hardwoods consist of Northern Red, Southern Red, White, Chestnut, Post, Black, and Scarlet Oak, along with Yellow-Poplar, Red Maple, Hickory, Sycamore, Black Gum, Black Locust, and Black Walnut. Softwoods consist of natural stands of Shortleaf, Virginia, Pitch, and White Pine, along with young plantations of Loblolly Pine.

It was noted that trees like Sycamore, Birch, Willow, and Ash tend to grow in the low wet areas along creek bottoms, while mast producing trees such as Oak, Hickory, and Walnut tended to grow on the drier benches above the stream bottoms.

Thirty-three percent of the forest stands are of sawtimber size containing more than 1,500 board feet per acre. Fifty-four percent of the stands are of pole size containing more than 500 cubic feet per acre. The remaining 13 percent supports seedling and sapling size stands.

Of the remaining land, the majority is in pasture and cropland. Crops included tree fruits, corn, small grains, and tobacco. See Table I for a comprehensive list of more important Buffalo River flora.

Streamflow direction in the upper reaches is south to southwest, turning to an east to southeast direction near the confluence of the North Fork and South Fork. Stream gradients vary widely. In the steep headwaters, gradients in excess of 200 feet per mile are not uncommon. In the central area gradients average about 20 feet per mile and range down to about 15 feet per mile in the downstream reaches.

Many tributaries varying in drainage area from less than one-half of a square mile to over 10 square miles make up the drainage pattern. The main stem of Buffalo River, a perennial stream, begins at the confluence of the North and South Forks near the community known as Forks of Buffalo. Other perennial streams which account for a major portion of the drainage are Franklin Creek, Thrashers Creek, Stonehouse Creek, Mill Creek and Muddy Branch which enter the main stem from a northerly direction. Puppy Creek, Beaver Creek, Long Branch, Huff Creek, and Tribulation Creek, all perennial streams, are the major tributaries on the southern side of the main stem. The main channel and most of the tributaries on Buffalo River required extensive cleaning and reshaping following Hurricane Camille in 1969.

TABLE I

BUFFALO RIVER WATERSHED

CROPS

Common Name	Scientific Name
Corn	*Zea mays*
Oats	*Avena sativa*
Rye	*Secale cereale*
Wheat	*Triticum aestivum*
Ky-31 fescue	*Festuca arundinacea*
Orchard grass	*Dactylis glomerata*
Red top	*Agrostis alba*
Italian rye grass	*Lolium multiflorum*
Sudan grass	*Sorghum sudanensis*
Ladino clover	*Trifolium repens latum*
Korean lespedeza	*Lespedeza stipulaceae*
Sericea lespedeza	*Lespedeza cuneata*
Soybeans	*Glycine max*
White clover	*Trifolium repens*
Sweet clover	*Melilotus spp.*
Tobacco, fire cured	*Nicotiana spp.*
Apples	*Malus spp.*
Peaches	*Prunus spp.*
Barley	*Hordeum spp.*
Alfalfa	*Medicago spp.*
Timothy	*Phleum pratense*
Sorghum	*Sorghum spp.*

TABLE I

BUFFALO RIVER WATERSHED

WEEDS

Common Name	Scientific Name
Pigweed	*Amaranthus spp.*
Hemp Dogbane	*Apocynum cannabinum*
Milkweed	*Asclepias spp.*
Chickweed	*Stellaria spp.*
Lambsquarter	*Chenopodium album*
Yarrow	*Achillea millefolium*
Ragweed	*Ambrosia artemisiifloria*
Giant Ragweed	*Ambrosia trifida*
Whiteheath Aster	*Aster pilosus*
Thistle	*Cirsum spp.*
Annual Fleabane	*Erigeron annus*
Horseweed	*Erigeron canadensis*
Cudweed	*Gnaphalium spp.*
Wild Lettuce	*Lactuca scariola*
Groundsel	*Senecio spp.*
Goldenrod	*Solidago spp.*
Dandelion	*Taraxacum officinale*
Cocklebur	*Xanthium pennsylvanicum*
Morning Glory	*Ipomoea spp.*
Wild Mustard	*Brassica kaber*
Pepperweed	*Lepidium virginicum*
Spurge	*Euphorbia spp.*
Dock	*Rumex spp.*
Pokeweed	*Phytolacca americana*
Plantain	*Plantago spp.*
Jimson Weed	*Datura stramonium*
Wild Carrot	*Dacus carota*
Henbit	*Lamium amplexicaule*

TABLE I

BUFFALO RIVER WATERSHED

LEGUMES

Common Name	Scientific Name
Vetch	*Vicia spp.*
Clovers	*Trifolium spp.*
Beggarweed	*Desmodium spp.*

GRASSES

Common Name	Scientific Name
Broomsedge Yellow Bluestem	*Andropogon virginicus*
Little Bluestem	*Andropogon scoparius*
Indiangrass	*Sorghastrum nutans*
Bermudagrass	*Cynodon dactylon*
Crabgrass	*Digitaria sanguinalis*
Barnyard Grass	*Echinochloa crusgalli*
Goosegrass	*Eleusine indica*
Bluegrass (Kentucky)	*Poa pratensis*
Foxtail	*Setaria spp.*
Johnsongrass	*Sorghum halepense*
Purpletop	*Tridens flavus*
Cheatgrass	*Bromus tectorum*
Orchardgrass	*Dactylis glomerata*
Fescue	*Festuca spp.*

TABLE I

BUFFALO RIVER WATERSHED

SHRUBS

Common Name	Scientific Name
Common Alder	*Alnus serrulata*
Arrowwood	*Viburnum dentatum*
Blueberry	*Vaccinium spp.*
Common Chinquapin	*Castanea pumila*
Black Haw	*Viburnum prunifolium*
Mountain-Laurel	*Kalmia latifolia*
Maple-leaf Viburnum	*Viburnum acerifolium*
Sweet-Pepperbush	*Clethra alnifolia*
Catawba Rhododendron	*Rhododendron catawbiense*
Rosebay Rhododendron	*Rhododendron maximum*
Strawberry-Bush	*Euonymus americanus*
Dwarf Sumac	*Rhus copallina*
Smooth Sumac	*Rhus glabra*
Staghorn Sumac	*Rhus typhina*
Common Spicebush	*Lindera benzoin*
New Jersey-Tea	*Ceanothus americanus*
Witch-Hazel	*Hamamelis virginiana*
Serviceberry	*Amelanchier spp.*

TABLE I

BUFFALO RIVER WATERSHED

TREES

Common Name	Scientific Name
Ash	*Fraxinus spp.*
Black Birch	*Betula lenta*
Red Birch	*Betula nigra*
Eastern Red Cedar	*Juniperus virginiana*
Wild Black Cherry	*Prunus serotina*
Flowering Dogwood	*Cornus florida*
Box Elder	*Acer negundo*
American Elm	*Ulmus americana*
Winged Elm	*Ulmus alata*
Black Gum	*Nyssa sylvatica*
Sweet Gum	*Liquidambar styraciflua*
Hackberry	*Celtis occidentalis*
Bitternut Hickory	*Carya cordiformis*
Mockernut Hickory	*Carya tomentosa*
Pignut Hickory	*Carya glabra*
American Holly	*Ilex opaca*
American Hornbeam	*Carpinus caroliniana*
Common Locust	*Robinia pseudocacia*
Cucumber Tree Magnolia	*Magnolia acuminata*
Red Maple	*Acer rubrum*
Silver Maple	*Acer saccharinum*
Black Oak	*Quercus velutina*
Black Jack Oak	*Quercus marilandica*
Chestnut Oak	*Quercus prinus*
Northern Red Oak	*Quercus rubra*
Post Oak	*Quercus stellata*
Scarlet Oak	*Quercus coccinea*
Southern Red Oak	*Quercus falcata*
Water Oak	*Quercus nigra*
White Oak	*Quercus alba*
Willow Oak	*Quercus phellos*
Persimmon	*Diopyros virginiana*
Loblolly Pine	*Pinus taeda*
Pitch Pine	*Pinus rigida*
Shortleaf Pine	*Pinus echinata*
Virginia Pine	*Pinus virginiana*
White Pine	*Pinus strobus*
Tulip-Tree	*Liriodendron tulipifera*
Redbud	*Cercis canadensis*
Sassafras	*Sassafras albidum*
Sourwood	*Oxydendrum arboreum*
Sycamore	*Platanus occidentalis*
Black Walnut	*Juglans nigra*
Black Willow	*Salix nigra*

The storm center of Hurricane Camille in August 1969 passed near the headwaters of Buffalo River, causing serious flooding over a wide area. The official rainfall record for this storm, a short distance northeast of the Buffalo River watershed, was 31 inches in 5 hours. A series of landslides occurred all along the eastern slopes of the Blue Ridge Mountains, including the headwaters of Buffalo River. These debris-avalanche type slides originated high up along the steep mountain slopes, moving huge volumes of mud, boulders, trees and anything else in its path. This tremendous volume of water, mud, and debris forced into narrow valleys and channels in such a short period of time, completely blocked or destroyed many of the water courses. Silt deposits caused flow to meander in all directions. Huge debris deposits of bounders, trees, remnants of homes, bridges, trucks, buildings, etc., were left throughout the flooded area.

One of the major objectives of the emergency measures undertaken following this storm was to assist the farmers and other landowners who had suffered severe losses to restore their lands and property to normal use as soon as possible.

Four operations were carried out in the restoration of these water courses:

a. Removal and disposition of the debris from the channels and other affected areas.

b. Restoration of the channel to a capacity similar to that before the flood.

c. Sloping the streambanks, where necessary.

d. Preparation of seedbeds, fertilizing and seeding all disturbed or bare areas with an adapted seed mixture.

Special consideration was given to ways and means of obtaining the quickest vegetative cover on the areas denuded by the slides and debris and the newly restored channel banks.

The town of Amherst water system intake is located on the main stem of Buffalo River about 1.5 miles northeast of the junction of U.S. Highways 60 and 29. The treatment plant has a capacity of 500,000 gallons per day. Finished water storage in the distribution system is 75,000 gallons, with average daily usage of about 280,000 gallons. This stream has been given a IIIA classification by the Virginia State Water Control Board, with special standards 1/ listed as suitable for public water supply in the water quality standards published by this Board June 1970. Average hardness of the water is 2 grains per gallon. There are no commercial, industrial, or urban pollutants discharged into the stream above this location. This system supplies water to residents of the town of Amherst. The remainder of the residents are supplied water from wells or springs developed by the various landowners.

1/ Virginia State Water Control Board, "Water Quality Standards," June 1970.

Water Quality - No chemical water quality data has been collected by the Soil Conservation Service, but the Virginia State Water Control Board has sampled Buffalo River since 1970. Almost all aspects of water quality were found to be excellent. A copy of the water quality report is attached as Appendix C.

The basic chemical parameters such as pH, Disolved Oxygen, Nitrate, Phosphates, Coliforms, and Pesticides are indicators of water quality. Extreme values in Appendix C indicated that Nitrates, Coliforms and pH infrequently approached unsatisfactory levels for short periods but the Virginia State Water Control Board suggested that the watershed was "disturbed" at these times. Based on the parameters and variations involved, they assumed that surface runoff during storm events causes these disturbances.

Water temperature readings taken during 1970, 1971, and 1972 were furnished by the Virginia State Water Control Board. Temperature readings ranged from 32° F. to 83° F. Winter readings from 32° F. to 50° F. were observed, spring readings ranged from 39° F. to 72° F., summer readings ranged from 63° F. to 83° F., and fall readings ranged from 38° F. to 64° F. All observations were made at midstream and mid-depth. Samples were taken at Highways 657 and 778. Highway 778 is located below sites 1B, 2, and 3; and Highway 657, a few miles below the Southern Railway outside the limits of the watershed.

TABLE II

CHEMICAL ANALYSES AT SITES 1B AND 4 [1]

Test Conducted	Site 1B		Site 4	
	2/22/71	3/11/71	2/22/71	3/11/71
Color [2]	5.6	3.2	67	22
pH	8.1	7.6	7.4	7.4
Iron (Fe)	0.34	0.33	2.57	0.90
Calcium (Ca)	8	7	9	11
Magnesium (Mg)	4	4	5.5	6.5
Sulfate (SO_4)	1.38	1.5	13.8	12.9
Chloride (Cl)	3.0	3.0	2.0	2.5
Fluoride (F)	0.14	0.07	0.07	0.06
Nitrate (NO_3)	0.45	0.45	0.69	0.73
Dissolved Solids	51	55	101	63
Total Hardness ($CaCO_3$)	12	11	14.5	17.5
Alkalinity	11	9	16	16
CO_2	1	1	2	1
Manganese	0	0	0.1	0.1
Phosphates	0.034	0.04	0.002	0.002

All measurements are parts per million.

1/ Supplied by Amherst County.
2/ Jackson Turbidity Units.

Climatic Data - Annual precipitation averages about 45 inches. About 27 inches of this precipitation normally occurs as rain between the first of April and last of September, with the remaining 18 inches occurring as rain or snow between the first of October and last of March. Floods have been recorded in all months. Some of the more troublesome flood problems are caused by storms of tropical origin which frequently pass through the area in summer and fall causing widespread flooding and serious damage. The most recent of this type storm was the remnants of Tropical Storm Agnes in June 1972 which was estimated to be a 10 to 20 year event in the Buffalo River watershed. From local reports a storm of the magnitude of the one in October 1972 (3.5 to 4.0 inches) has a recurrence interval of 2 to 5 years in Buffalo River. The remnants of Hurricane Camille in August 1969 produced up to 27 inches of rainfall and flood stages far in excess of those expected from a storm with a recurrence interval of 100 years. The average annual runoff for this watershed is 21 inches. The 7-day 10-year drought flow is estimated to be 8.9 cfs at the Southern Railway tracks.

Temperatures in this area average about 38 degrees Fahrenheit in winter and 76 degrees in summer. Winter time low temperatures below zero sometimes occur as over-night lows for a few days at the time. During occasional hot spells in summer, temperatures sometimes reach 100 degrees or more for a few days. The lowest official temperature recorded in this area is 16 degrees below zero, and the highest 105 degrees above zero. The average growing season is about 190 days from mid-April to late October.

Economic Data - Sale of dairy and livestock products accounts for most of the agricultural income in this watershed. Agriculture is an important segment of the county's economy; even though more people are employed in manufacturing and other off-farm work than are engaged in farming.

The total watershed acreage is 60,500 acres. About 4,840 acres are estimated to be in cultivated crops and orchards, 44,770 acres in forest land, 9,680 acres in pasture and 1,210 acres in miscellaneous uses. See Table III. Approximately 600 acres of cultivated crops, 729 acres of hay, 1,043 acres of pasture and 471 acres of other uses, mostly forest land and idle land occur on the flood plain. Per acre production levels on the flood plain with the existing flood hazard are about 18 tons of silage, 80 bushels of corn grain, 2.5 tons of hay and 110 animal grazing days of pasture.

TABLE III

EXISTING WATERSHED LAND USE - 1970

Land Use	Flood Plain Acres	Upland Acres	Total Acres
Cropland	1,329	3,511	4,840
Pasture	1,043	8,637	9,680
Forest	431	44,339	44,770
Urban and Builtup	10	692	702
Miscellaneous 1/	30	478	508
Total	2,843	57,657	60,500

1/ Miscellaneous includes road rights-of-way, and a few miscellaneous unclassified areas.

Public lands in this watershed consist of 6,560 acres in the George Washington National Forest managed by the U.S. Forest Service and areas needed for highway rights-of-way. The remaining 53,940 acres are in private ownership.

The 315 farms in the watershed average about 200 acres in size. An estimated 3,500 people live in the watershed. Of these, about 1,100 are rural nonfarm residents living on small tracts along the primary and secondary road systems. The farm population is estimated at 900. About 1,500 people are urban residents living in and around the town of Amherst.

Currently land values, exclusive of buildings, range from $50 to $3,000 per acre depending on its quality, location, accessibility, availability of utilities, and development costs. Flood plain land values are estimated at about $300 to $500 per acre for agricultural use and up to $2,000 per acre for commercial or industrial use as part of tracts with useable upland. Where the lands are protected sufficiently for development for nonagricultural uses it is estimated that their value, exclusive of buildings, would increase to about $3,000 per acre if easily accessible, and about $2,000 per acre where they are not adjacent to existing roads.

The entire watershed is easily accessible from a network of public, private and national forest roads. U.S. Highways 60 and 29 intersect at Amherst. These are major national arterial highways providing access to all parts of the nation. Motor freight service is available from about eight motor carriers at Amherst. Most of these companies provide interstate and intrastate service. Lynchburg, about 20 miles away, has 15 truck terminals. The mainline of the Southern Railway, which operates between Washington, D. C. and Birmingham,

Alabama passes through Amherst. It is one of the major railroads of the nation and provides railway connections to all parts of the country. Eastern Greyhound Lines and Continental Trailways serve the area with frequent daily bus schedules. Interconnections with other lines provide adequate bus service to all parts of the nation. There are no licensed airports in Amherst County. Preston Glenn Field, Lynchburg's municipal airport, is about 25 miles from Amherst. This field is attended 24 hours a day with 16 regular scheduled flights providing service to other Virginia cities and Washington, D. C. Runway lighting, beacon, fuel, repairs and charter service along with ground transportation, food and lodging are available.

In general, the economy of the watershed is fair to good. Over 90 percent of the farms had gross sales of less than $5,000 in 1960. The farms in the watershed range in size from less than 30 acres for some of the part-time operations to 732 acres for the largest operation in one ownership. Most of the commercial farms are one-family, owner-operated units, with day labor hired as needed to help harvest crops. A few of the larger operations employ both day labor and full-time employees who live on the farm and are paid a monthly salary. In recent years over half of the rural farm population has found it necessary to supplement their income with off-farm employment. This trend is expected to continue as the Lynchburg area grows. Population projections indicate that the population of the watershed will increase to between 9,500 and 11,500 by 1980 and to about 20,000 by the year 2000.

Electricity and telephone service are provided to all parts of the watershed. The town of Amherst owns its water system which supplies the area inside the town corporate limits. Their treatment plant has a capacity of 500,000 gallons a day. Water usage by the 1,500 people presently being served by the system is averaging about 280,000 gallons daily. Studies indicate that a constant demand in excess of 300,000 gallons a day must be provided through surface storage. The town also operates a sewerage treatment plant which provides primary treatment and continuous chlorination to serve a population of about 1600. Plans have been developed to supply natural gas to the Amherst area. These and other public utility plans are continually reviewed and facilities added, as needed, to provide for increased demands.

An estimated 38,210 acres of forest land is in private ownership in this watershed. Income from the sale of forest products is realized by most of the landowners. Forest fire protection is provided by the Virginia Division of Forestry in cooperation with the U.S. Forest Service. There are 43 landowners with flood plain land in the area downstream from the proposed structural measures in tracts ranging from 1 acre to 200 acres. Agricultural use and management of the flood plain with the present flood hazard will be limited to a medium to low level, with farm income proportionately low.

Land Treatment Data - General cover conditions in this watershed are considered to be good to fair and have improved in recent years. Severely eroding areas in need of special attention are relatively small and scattered throughout the watershed. Quite a few are the results of slides caused by Hurricane Camille in August 1969. Revegetation of slides caused by Camille required immediate emergency action by landowners and operators. This was done in cooperation with a number of State and Federal agencies providing financial and technical assistance. These areas have now been largely stabilized and are being maintained by the landowners as a part of their regular conservation program.

The major man-made erosion problems are related to cropping upland soils considered marginal or unsuited, plus inadequate application of conservation practices on most of the remaining cropland. The inadequacy of practices is especially identified with the upland where they are needed the most. This is discussed in more detail in the section on Erosion Damage.

A continuing effort is being made to develop more widespread use of conservation measures by the landowners and operators. The flood hazard is limiting the management and use of over half of the flood plain land. This increases the amount of upland required for cultivated crops, adding to the erosion and sedimentation problems and tending to reduce the operating profit margin on most farms.

About 48 percent of the farms, encompassing about 50 percent of the agricultural land in the watershed are being operated under soil and water conservation agreements with the Robert E. Lee Soil and Water Conservation District. Seventy-two operators have developed resource conservation plans for their entire units; with the remaining 79 in the process of developing complete plans. Approximately 90 percent of the practices planned to date have been applied.

Of the 6,560 acres of U.S. Forest lands within the project boundary, 768 acres have been identified by the Forest Service as requiring treatment.

Fish and Wildlife and Recreation Resources - The upper reaches of the Buffalo River, primarily the North and South Forks and Thrashers Creek, are characteristically cold, swift water streams. Bottoms are primarily gravel with occasional sandy bars and silt bottom pools. North and South Forks contain brook trout which prefer water 40° to 50° F. for spawning in the fall. The presence of swift water over shallow gravel induces movement of white suckers,from the deeper slower water areas below, upstream for spawning. Thus, some competition for food and disruption of spawning area between such fish and

trout occurs. The firm bottoms of gravel in swift water provide ideal habitat for stoneflies, mayflies, and various species of caddis flies.

According to published plans of the Virginia Commission of Game and Inland Fisheries, the only stream stocked with trout within the watershed in the last five years was the North Fork of the Buffalo River. This was stocked with brook, rainbow, and brown trout in 1967, 1968, 1969 and 1970. No streams in the watershed have been stocked since 1970.

The lower reaches of Buffalo River support moderate populations of smallmouth bass and other species of sunfish which inhabit slower moving, deeper, warmer water. The presence of smallmouth bass indicates upper temperature limits of 80° F. with common temperatures between 60° and 80° F. during the summer months. This is supported by the water quality data obtained.

The lower reaches have sandy to silty bottoms on which aquatic vegetation grows in slack water areas. Such habitats provide conditions for crayfish, salamanders, frogs, pumpkinseed, bluegill and redbreast sunfish. These species increase as the water temperature increases downstream. However, the total alkalinity readings varying between 9 and 16 ppm, and sulfate readings between 1.38 and 13.8 ppm, suggest low productivity.

The watershed presently supports good populations of squirrel, rabbit, and various nongame birds and mammals. Fair numbers of deer are present, and somewhat lower densities of wild turkey and quail. Terrestrial wildlife habitat is based on the quality and quantity of vegetative communities. Such communities as annual plants, grasses and legumes, shrubs, hardwoods and coniferous trees provide elements of habitat. This watershed has a variety of vegetative communities in various stages of succession. The cultivated land provides annual weedy plants and grain and seed crops. There are 4,840 acres of cultivated land distributed throughout the watershed. This acreage includes grasses and legumes planted for hay.

Annuals require bare soil on which to become established and grow. They compete poorly with other species, especially the perennials and quite poorly with their own and similar kinds. Unlike other plants, the only living part of annuals that survives the year is the seed. Annuals develop seed in great abundance and most of them are durable and long lived. Therefore, annual plants are very valuable in furnishing wildlife food. The most valuable wildlife food among the cultivated annuals is corn, followed closely by wheat and oats. There are about 300 acres planted to corn each year and about 150 acres of small grain. About 150 acres, in addition, are idle each year.

Among the wild annuals which provide food are barnyard grass, lambsquarter, ragweed, foxtail, pigweed, chickweed, and smartweed. Characteristic wildlife species of openland are blackbirds, meadowlarks, mourning doves, sparrows and finches. Other species of wildlife which use open cultivated or weedy areas but are dependent upon a mixture of vegetative types are bobwhite quail, cottontail rabbits, shrews, and meadowmice.

Grasses and legumes provide a very important element of wildlife habitat. They provide nesting and other types of dense, low wildlife cover and furnish food for a wide variety of mammals and birds in particular situations. There are no, or very few, spots in the watershed where grasses represent the climax vegetative community. Therefore, whether natural or planted, grasses and legumes make up a very unstable and short-term plant community unless well cared for.

There are 9,680 acres of pastureland in the watershed. Approximately 1,400 acres are native grasses and 8,280 acres planted. Practically all grasses and legumes have some erosion control and wildlife values. Fescue, bluestem, and orchardgrass provide nesting areas for field sparrows, meadowlarks, bobwhite quail, cottontail rabbits, meadowmice and short-tailed shrews. Whitetailed deer, wild turkeys, bobwhite quail, meadowlarks, field sparrows and cottontail rabbits feed on the tender growth of a wide variety of grasses and legumes as well as the small seeds and insects found in association. Grass and legume areas are more valuable and useable if woody vegetation is nearby.

Within the watershed, shrubs occupy two principal ecological habitats. They form an intermediate or unstable community between the plant succession stages represented by mixed herbaceous perennial plants and the dominant or overstory tree community composed of such species as oak, hickory, poplar, maple, birch, and pine. Shrubs also are an element of tree communities --forming distinct layers in forest lands. Usually different shrub species are represented in these two situations.

In shrub stages of plant succession, there is considerable variation in the ability of different species to maintain themselves. Some, such as dewberry, blackberry, and raspberry, have a relatively short period of dominance. They are replaced by dogwoods, sumac, elders, hazelnut, and other species which are intermediate in span of dominance. Flowering dogwood, hawthorn, and redbud are late stage plants that persist in abundance even after trees have become dominant. Shrubs seem to fall in about the following categories, successionally:

Early Stages	Mid Stages	Late Stages
dewberry	hazelnut	flowering dogwood
blackberry	poison ivy	hawthorn
raspberry	sumac	redbud
blue berry	honeysuckle	spice bush
huckleberry	elder	shad bush

Many forms of wildlife find the shrubs a valuable source of food and cover. Included are the whitetail deer, ruffed grouse, bobwhite quail, woodchucks, jays, thrashers, robins, cardinals, and cedar waxwings.

Trees occupy the final stage of plant succession in this watershed. They have a high degree of stability and major changes are relatively slow unless disrupted by man's activities. Trees provide dens, nest sites, seeds, fruits, buds and nuts valuable for a wide variety of wildlife species. Coniferous tree species provide habitat for thrushes, pine warblers, whitetail deer, fox squirrels, mice and cottontail rabbits. Pines mixed with hardwoods are more valuable. Characteristic wildlife associated with hardwood forest are ruffed grouse, deer, opossum, gray and fox squirrel, cottontails, brown thrasher, cardinal, woodpecker, wood thrush and red-eyed vireo. See Tables IV, V, and VI for list of Buffalo River fauna.

There are 44,770 acres of forest land throughout the watershed. Approximately 431 acres occur in the flood plain and the remainder in the upland. The forest land is composed of mixed pine and hardwoods, shrubs, pine plantations, and hardwood bottoms.

This project lies in an area where almost no facilities have been developed for public outdoor recreation. Hunting and fishing in the George Washington National Forest requires a special National Forest stamp in addition to the regular State or county license. Most of the private land in the watershed is posted with access for hunting and fishing limited to local residents granted written permission on a day-by-day basis by the landowners.

Archeological and Historical Values - A careful search and review of the National Register of Historic Places was conducted and the Virginia Historic Preservation Liaison Officer and State Archeologist were consulted. Correspondence with the Virginia Historic Landmarks Commission indicates two 18th century homes which they are considering for nomination to the National Register of Historic Places. Neither house will be affected by this project. Investigations by Soil Conservation personnel have not found any known historical landmarks or any evidence of archeological significance which would be affected by the proposed project.

The National Park Service was notified with respect to the project and the National Historic Preservation Act of 1960 (80 Stat. 915) and Public Law 86-523, 86th Congress S. 1185, 1970. The National Park Service and the Virginia State Archeologist will be notified prior to any construction and in the event anything of significance is found during construction.

TABLE IV

Mammal Species Commonly Observed in the Buffalo River Watershed Area

Common Name	Scientific Name
Whitetail deer	*Odocoileus virginianus*
Black bear	*Ursus americanus*
Opossum	*Didelphis virginiana*
Raccoon	*Procyon lotor*
Red fox	*Vulpes fulva*
Gray fox	*Urocyon cinereoargenteus*
Woodchuck	*Marmota monax*
Gray squirrel	*Sciuirus carolinensis*
Eastern chipmunk	*Tamias striatus*
Muskrat	*Ondatra zibethica*
River otter	*Lutra canadensis*
Shorttail weasel	*Mustela erminea*
Mink	*Mustela vison*
Striped skunk	*Mephitis mephitis*
Eastern cottontail	*Sylvilagus floridanus*
Voles	*Microtus spp.*
Mice	*Peromyscus spp.*

TABLE V

Bird Species Commonly Observed in the Buffalo River Watershed Area

Common Name	Scientific Name
Wild turkey	*Meleagris gallopavo*
Ruffed grouse	*Bonasa umbellus*
Bobwhite quail	*Colinus virginianus*
Mourning dove	*Zenaidura macroura*
Rock dove	*Columba livia*
Mallard	*Anas platyrhynchos*
Black duck	*Anus rubripes*
American widgeon	*Mareca americana*
Wood duck	*Aix sponsa*
Red-tailed hawk	*Buteo jamaicensis*
Marsh hawk	*Circus cyaneus*
Sparrow hawk	*Falco sparverius*
Great horned owl	*Bubo virginianus*
Screech owl	*Otus asio*
Turkey vulture	*Cathartes aura*
Black vulture	*Coragyps atratus*
Crow	*Corvus brachyrhynchos*
Chimney swift	*Chaetura pelagica*
Barn swallow	*Hirundo rustica*
Yellow-shafted flicker	*Colaptes auratus*
Blue jay	*Cyanocitta cristata*
Tufted titmouse	*Parus bicolor*
Mockingbird	*Mimus polyglottos*
Brown thrasher	*Toxostoma rufum*
Robin	*Turdus migratorius*
Starling	*Sturnus vulgaris*
Eastern meadowlark	*Sturnella magna*
Red-wing blackbird	*Agelaius phoeniceus*
Common grackle	*Quiscalus quiscula*
Cardinal	*Richmondena cardinalis*
Indigo bunting	*Passerina cyanea*
Slate-colored junco	*Junco hyemalis*
House (English) sparrow	*Passer domesticus*
Grasshopper sparrow	*Ammodramus savannarum*
Chipping sparrow	*Spizella passerina*
Field sparrow	*Spizella pusilla*
White-throated sparrow	*Zonotrichia albicollis*
Red-bellied woodpecker	*Centurus carolinus*
Wood thrush	*Hylocichla mustelina*
Red-eyed vireo	*Vireo olivaceus*
Rufous-sided towhee	*Pipilo erythrophthalmus*

TABLE V (Continued)

Common Name	Scientific Name
Carolina chickadee	*Parus carolinensis*
Carolina wren	*Thryothorus ludovicianus*
Pine warbler	*Dendroica pinus*
Yellow-breasted chat	*Icteria virens*
American goldfinch	*Spinus tristis*

Sources: The Breeding Bird Survey; 1966, 1967, 1968, and 1969 United States Department of The Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and the Breeding Bird Survey in Virginia, 1966-1968, Willet T. Van Velzen.

TABLE VI

Fish Species Known in Buffalo River

Common Name	Scientific Name
Bluegill	*Lepomis macrochirus*
Pumpkinseed	*Lepomis gibbosus*
Redbreast	*Lepomis auritus*
Common shiner	*Notropis cornutus*
Creek chubsucker	*Erimyzon oblongus*
Brown bullhead	*Ictalurus nebulosus*
Carp	*Cyprinus carpio*
Chain pickerel	*Esox niger*
Bluntnose minnow	*Pimephales notatus*
Smallmouth bass	*Micropterus dolomieui*
Brook trout	*Salvelinus fontinalis*
White sucker	*Catostomus commersoni*
Bluehead Chub	*Nocamis leptocephala*
Satinfin shiner	*Notropis analostanus*
Swallowtail shiner	*Notropis procne*
Johnny darter	*Etheostoma nigrum*
Margined madtom	*Noturus insignis*
Northern hog sucker	*Hypentelium nigricans*
Fantail darter	*Etheostoma flabellare*

Sources: Dr. Robert D. Ross and George M. Simmons, Virginia Polytechnic Institute and State University, 1973; and Dr. Robert E. Jenkins, Roanoke College, Salem, Virginia, 1973.

Water and Related Land Resource Problems:

Stream gage records from the USGS Water Resources Data for Virginia (Surface Water Records) were used in determining the number of floods producing storms on the watershed. These records, which show floods since 1940, are based on two gaging stations; one, on the Tye River near Norwood, Virginia (D.A. = 360 square miles) operated from 1940 to 1960; the other, on Buffalo River near Tye River, Virginia (D.A. = 147 square miles) operated from 1960 to present. These two gages are 13.4 miles and 9.8 miles downstream, respectively, from the lower limits of the project area. The base discharge for the downstream gage is 3,000 cfs and for the upstream gage is 1,400 cfs. Field investigations on the watershed show that these base discharges are closely related to out-of-bank flooding on the watershed. The point where out-of-bank discharge begins is the point of beginning damages. This area is subject to floods at any season of the year with the most damaging ones occurring following high intensity, short duration rainfall giving little or no warning for action to avoid losses. The flooding of agricultural bottom lands in some cases, occurs two or three times a year. The most devastating storm known to have ever occurred in this area was from Hurricane Camille in August 1969. Rainfalls of up to 27 inches were reported for the period from 8:00 p.m. August 19 to 4:00 a.m. August 20. This produced a discharge at the gage on Buffalo River estimated to be about 5.5 times the discharge to be expected from a storm occurring once in 50 years. Flood stages were produced on Buffalo River which exceed the estimated 100-year frequency storm by as much as 15 feet. Damage from Camille in this watershed was estimated in excess of $500,000, with some reports indicating as much as 1.5 million dollars. In contrast to this, the estimated damage from a 100-year frequency storm is about $85,700.

In addition to the flood plain actually inundated by the 100-year frequency storm, there are about 100 acres of terrace bottom land above this elevation which cannot be used or managed to its most productive potential due to the flood hazard. These are relatively small areas adjacent to the flood plain, and for accessibility must be operated as parts of fields subject to flooding. Since these areas cannot be operated independently, they cannot be managed to produce to their potential. There are approximately 500 acres of flood plain land along the main stem of Buffalo River between the downstream limit of this watershed area and the confluence of Buffalo and Tye Rivers which have problems similar to those in this watershed.

Floodwater Damage - Storms of the 5-year frequency magnitude block road approaches, the 4 bridges on state route 610, and inundate nearly half of the 100-year frequency flood plain. The 100-year frequency storm blocks all the roads in the flood plain. Health hazards often arise when sediment and debris deposits occur on the

flood plain and in springs which are used as rural water supplies for one or more families. Flood-blocked roads cause long detours to market products or reach places of off-farm employment. This results in loss of income because a sale cannot be made or a place of employment cannot be reached.

Flood plain land values with the present flood hazard are generally comparable to the adjacent upland where they can be used for cropland or pasture. Some of the areas which are highly vulnerable to flooding often actually tend to reduce the total value of a tract, thus are considered less valuable than the adjacent upland areas. Without the proposed project installed, additional development or more intensive use of these flood plain areas will require very expensive floodproofing measures which are not considered to be practical by the landowners.

The 100-year frequency storm inundates an estimated 2,843 acres of flood plain land. Landowners report that where the flood hazard is such that modern production technology can be used on the flood plain production on two acres is at least equal to the production on three acres of the best upland. Due to the flood hazard, almost none of this 2,843 acres of flood plain can be managed to produce to its inherent potential. This is causing increased farm operating costs and inefficient use of both human and natural resources. Average annual damages to crops and pasture amount to $8,370, of which $7,725 is from land use limitations due to flooding.

Agricultural improvements in the flood plain consist chiefly of farm roads, fences and a few small structures which vary widely in their susceptibility to damage. The average annual damage to these improvements amount to $2,405.

Major fixed improvements include the water treatment plant and raw water intake for the town of Amherst located a short distance below the confluence of Huff Creek with Buffalo River. Other improvements in the area include a ready-mix concrete operation, several farmsteads, homes and miscellaneous buildings. Annual damages to these improvements amount to $4,230.

There are 8 highway bridges and about 3-1/2 miles of roads in the flood plain area benefited by this project. U.S. Highway 60, a major connecting link between the ports at Hampton Roads with the cities of the midwest, crosses Buffalo River just downstream from site 1B. Also U.S. 29, a major north-south highway between Washington, D. C. and Atlanta, Georgia, crosses Buffalo River in the downstream area of the watershed. The other roads and bridges are of local importance as access routes to market and off-farm employment. Damages to these improvements amount to $4,820 annually in addition to costs of traffic delays, re-routing and other indirect effects.

Recent rural nonfarm growth coupled with expanded availability of public utilities and improved transportation facilities make it desirable to develop certain areas adjacent to existing highways. Local planning bodies desire to develop these areas for residential and commercial uses to meet growing local needs.

Sediment Damage - Frequent flooding deposits sediment over much of the flood plain. Sediment deposition has reduced the productive capacity on approximately 269 acres of flood plain land. This has resulted in a loss of income averaging about 10 percent.

Sediment deposition on about 3.5 miles of roads and 8 bridges during flood flows cause extra cleanup and maintenance and is a hazard to motorists who often come upon these thin layers of slick mud with little or no warning. Bedload movement during flood flows restricts bridge and channel capacities which impedes the flow causing higher stages and lowers the quality of the water for various uses.

Sediment originating in this watershed is carried into the James River much of which eventually reaches the estuary and Hampton Roads. Approximately 43,680 tons per year are delivered to the James River from the drainage area of Buffalo River.

Erosion Damage - Erosion of the upland areas being cropped has been a more serious problem in the past than at present. In recent years an increased application of conservation measures has helped reduce the problem.1/ Sheet erosion rates average about 20 tons per year on all cropland with an average loss from the total watershed acreage of about 7 tons per acre per year. Erosion rates from untreated road cuts and fills can exceed 100 tons per acre per year.

The planning investigation revealed that about 50 acres of agricultural bottom land have been damaged by scour in amounts varying from 20 to 40 percent. These damages are estimated to be $1,480 annually.

Problems Relating to Water Management - A study of the watershed did not reveal a need for project-type drainage or irrigation developments at this time.

Amherst County makes up part of the Lynchburg Standard Metropolitan Statistical Area, which also includes Campbell County and the City of Lynchburg. This area is approaching a transitional period from an agriculturally based economy to one supported more by industry and commerce.

1/ Table 1A "Status of Watershed Works of Improvement", Work Plan - Buffalo River Watershed.

TABLE VII

Population Projections

	Watershed Area [1]	Amherst County
1970	3,500	26,072 [2]
1980	9,500 - 11,500	34,000 [3]
2000	20,000	48,578 [3]

1/ Based on 1970 census data and University of Virginia studies of county population projections.
2/ 1970 U.S. Census Data.
3/ Based on studies by University of Virginia, Bureau of Population and Economic Research.

The Amherst County Water Authority has been established to provide an adequate water system to meet the anticipated demand. Based on these population projections, consultant engineers retained by the sponsors indicate the need to increase the dependable water supply by eight million gallons a day. They report that present demands are substantially equal to the current dependable supply, and that further growth of the area depends on expansion of the present system and development of additional storage for municipal use. In order to provide for orderly development of the natural resources of the area, the consultants recommend providing storage in sites 1B and 4 for municipal and industrial use in addition to that needed for floodwater and sediment.

Planned Project:

Land Treatment - The land treatment phase of the plan will consist of technical and financial assistance to prepare resource inventories, complete soil surveys, prepare conservation plans and provide application assistance on the part of the Soil and Water Conservation District, the Soil Conservation Service, the U.S. Forest Service, and those State and Federal agencies with a role and responsibility.

The planning and application of conservation measures on private land will be in cooperation with the Robert E. Lee Soil and Water Conservation District. Land treatment measures will be planned and installed

on 768 acres of Federal land by the U.S. Forest Service. Technical assistance for planning and installation of measures on private land will be provided by the Soil Conservation Service. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide technical assistance as needed for installing measures on private forest land.

The land treatment phase of the plan will be accomplished by cooperating with the Soil and Water Conservation District to assist owners and operators, prepare and keep current their resource conservation plans as well as apply and maintain conservation practices. Action on the part of landowners and operators is contingent on their desire and ability to make the decisions which result in sustained use of the resource base and maintain a quality environment. It is anticipated that the efforts of the Soil and Water Conservation District, the landowners and operators and the agencies will result in maintaining lands now adequately protected. By 1980, their efforts should result in additional adequate treatment of 2,300 acres of cropland, 4,695 acres of grassland, 38,210 acres of forest land, and 120 acres of miscellaneous land. Soil surveys, resource inventories and evaluations, and other needed technical assistance will provide basic information needed by owners and operators for planning, installing and maintaining soil and water conservation measures and land use changes.

Soil surveys will be completed on 49,260 acres of private land to obtain data necessary to properly advise landowners and operators in their land use problems. Soil surveys are an inventory of the different kinds of soil in a survey area. They show the location of each kind of soil on an aerial photo base and describe the physical and chemical characteristics of each soil. A soil survey is a basic tool in making sound land use decisions.

Application of the following conservation practices is anticipated in the area:

a. Conservation Cropping System: Growing crops in combination with needed cultural and management measures - approximately 2,300 acres.

b. Contour Farming: Farming sloping cultivated land in such a way that plowing, preparing land, planting, and cultivating are done on the contour - approximately 100 acres.

c. Critical Area Planting: Planting vegetation such as trees, shrubs, vines, grasses or legumes on critical areas - approximately 60 acres.

d. Crop Residue Management: Using plant residues to protect cultivated fields during critical erosion periods - approximately 200 acres.

e. Grassed Waterway: A natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure - approximately 35 acres.

f. Minimum Tillage: Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage - approximately 500 acres.

g. Pasture and Hayland Management: Proper treatment and use of pastureland or hayland - approximately 3,000 acres.

h. Farm Ponds: Approximately 20.

Also involved will be wildlife habitat management, tree planting, protection and maintenance of existing forest cover and forest fire protection.

Wildlife habitat will be maintained and, in many cases, improved in the watershed by developing conservation plans with landowners which include the following practices to aid in erosion control, improve land cover, increase infiltration and reduce runoff: Establish contour farming on slopes, with alternate bands of crops and grasses to provide edges where wildlife, food and cover are close together. Protect fields from erosion by leaving stubble and other crop residues on the surface, which will furnish waste grains and seeds for birds. Plant cover crops of legumes and grasses in orchards to protect bare soil and provide travel lanes, as well as food and cover. Odd areas, such as abandoned roads, road cuts, ditchbanks and field corners will be seeded to prevent erosion and provide islands of wildlife, food and cover. Establish grassed waterways to move water down slopes to help keep streams, ponds, and reservoirs free of sediment. Build ponds for livestock water, fishing, and fire protection. Protect forests, fence rows, and other areas from unwanted fires. Delay mowing of headlands, roadsides, and watercourses until after the nesting season. Prevent overgrazing, especially in forest lands. Construct walkways for livestock in marshy areas. Fence around ponds and provide livestock watering troughs to one side. Leave den trees when cutting hardwood timber and piling brush.

Land treatment measures on private forest land include logging road stabilization on 5 miles, tree planting on 150 acres, cultural treatment measures on 4,020 acres, forest land grazing control on 2,000 acres, and skid trail and logging road protection on 200 acres. Management advice for forest landowners will consider the multiple-use aspects of forest management.

Land treatment measures on National Forest land include erosion control on 29 acres and hydrologic cultural operations on 739 acres.

Soil surveys will be completed on 49,260 acres of private land in order to properly advise landowners and operators in their land use problems.

The planning and application of measures on private land will be in cooperation with the Robert E. Lee Soil and Water Conservation District. Land treatment measures will be planned and installed on Federal land by the U.S. Forest Service. Technical assistance for planning and installation of measures on private land will be provided by the Soil Conservation Service. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide technical assistance as needed for installing measures on private forest land.

Structural Measures - Planned structural measures include two floodwater retarding structures and two multiple-purpose structures, as shown on the watershed project map. The dams range in height from 55 to 85 feet, and the drainage areas range from 4.99 to 24.07 square miles.

The 4 structures will provide 9,630 acre-feet of flood storage and will control the 100-year frequency runoff from 28,155 acres, or 46.5 percent of the total watershed area. The floodwater detention capacity is equivalent to 4.10 inches of runoff from the area above structures, or 1.91 inches from the entire watershed area. Storage capacity will be provided for the 100-year sediment volume in each structure. Total sediment capacity for all structures will be 2,619 acre-feet. Average annual rates of sediment accumulation at the reservoir sites, based on a 100-year volume capacity, amounts to 12.81, 4.77, 3.99, and 4.34 acre-feet for sites 1B, 2, 3 and 4, respectively. The 2 multiple-purpose structures will store 4,049 acre-feet of water supply for Amherst County.

The multiple-purpose reservoirs and the sediment pools of the floodwater retarding structures will be stocked with warm water fish such as largemouth bass, sunfish and channel catfish by Amherst County. The exact number of fish to be stocked will depend to a large degree on availability of numbers and species at that time. Experience has shown that a stocking ratio of 10 sunfish for each bass works the best, with up to 500 sunfish and 50 bass per surface acre. Fifty to 100 channel catfish per acre can be added if desired. Management will be in accordance with Farmers' Bulletin No. 2250 USDA "Warm Water Fishponds" and recommendation from professional fish biologists. Public access to the reservoirs will be provided for fishing for a set fee. These are component parts of the recreation and wildlife plan which has been developed by Amherst County.

Relocation of farm operations or businesses will not occur as a result of land rights acquisitions for this watershed project. Installation

of the 4 dams will require the purchase of, or flowage easements on, 719 acres of land; including 245 acres for sediment, 168 acres for water supply, 265 acres for floodwater detention, and 41 acres for the structures. Current land use in the sediment, water supply, and flood detention pools, and in the construction area consists of 488 acres of cropland, 164 acres of pasture, and 67 acres of idle and miscellaneous uses. All of this land was privately owned at the beginning of the project. Amherst County will purchase the sediment and water supply pools, and enough additional land to provide public access to the reservoirs for fishing. In addition, they will provide flowage easements to the design high water elevation for each structure.

Fish barriers, rock-filled gabion type structures, will be constructed above structures 1B and 2 in order to preclude the migration of fish (centrarchids) from the reservoir areas into trout waters upstream.

During the construction period it is estimated a maximum of 3.0, 1.8, 1.9, and 1.6 acre-feet of sediment could be produced at sites 1B,2, 3 and 4, respectively. The effects of onsite erosion control measures and practices will reduce the amount of sediment by 60 percent; to 1.2, 0.7, 0.8 and 0.6 acre-feet, respectively. Equivalent values of reduced sediment concentration (turbidity) for these sediment yields are 74, 160, 226 and 120 ppm, respectively.

During construction appropriate measures will be taken to minimize soil erosion and water and air pollution. These measures will be determined on a site by site basis by evaluating the pollution hazard in relation to established standards for the area in question.

The Soil Conservation Service will maintain watch for archeological and historic values during the construction stage. Items of value uncovered by the Soil Conservation Service will be brought to the attention of the United States Department of the Interior, or Virginia Historic Landmarks Commission. Appropriate arrangement will then be made for study, salvage or other action as needed.

Plans and specifications for structures will provide for control of erosion and sedimentation through the use of such measures as temporary vegetation or mulch, sediment and debris basins, and temporary bridges or culverts. Special efforts will be made to complete and to protect project segments as rapidly as construction schedules will permit. In addition, appropriate measures will be used if construction is suspended for an appreciable length of time.

Contractors will be required to manage the construction activities so as to either eliminate or minimize within tolerable limits the effects of pollution from sources such as dust, open fires, trash, oil, noise, etc.

Operation and Maintenance - Land treatment measures on non-Federal land will be operated and maintained by the landowners and operators through cooperative agreements with the Robert E. Lee Soil and Water Conservation District. Land treatment measures on Federal land will be maintained by the George Washington National Forest of the U.S. Forest Service.

Amherst County will be responsible for the operation and maintenance of all structural measures including the raw water intake systems for sites 1B and 4 and the fish barriers above dams 1B and 2 at an estimated cost of $5,500 annually. This will consist primarily of mowing, liming and fertilizing the dam and spillway, seeding and mulching of bare areas, repairing gullies that may occur in the dam area and painting the trash racks. In addition it may be necessary to replace elements of the structures such as the trash rack and upstream fish barriers during the useful life of the project.

Facilities provided for recreational use will be operated and maintained by the county. This will consist primarily of proper maintenance of the sanitary facilities required by State and local health regulations, fences, access roads, parking lots and general conditions of the area.

The designated representatives of the Service and the sponsors will make a joint inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structural measures. These inspections will continue for 3 years following the installation of each structural measure. Inspections after the third year will be made by the sponsors. They will prepare a report and send a copy to the Service employee responsible for O & M inspection follow-up. These reports will be thoroughly reviewed by the Service representative. Any evidence of needed inspections or maintenance not being performed properly will be reported immediately and appropriate action taken by the responsible sponsors. All maintenance agreements will be properly completed before execution of project agreements.

Project Costs - It is anticipated that the project can be installed in 6 years at a total cost of $2,556,035, of which Public Law 566 funds will provide $1,494,510 and others $1,061,525. Land treatment measures are estimated to cost $406,585 with Public Law 566 funds providing $154,200 for accelerated technical assistance and soil surveys, and other funds $252,385 for installation costs. Structural measures are estimated to cost $2,149,450, with Public Law 566 funds bearing $1,340,310 and others $809,140. Construction costs of the structures is estimated at $1,415,800 of which $1,126,655 will be supplied from Public Law 566 funds and $289,145 from other funds.

Environmental Impact

Conservation land treatment measures in the watershed will improve hydrologic cover conditions and wildlife food and habitat. Installation of land treatment measures, in combination with structural measures, will enable residents in and near the watershed to encounter fewer blocked roads, suffer less from reduced incomes and generally realize an improved environment.

Installation of this project will permit 43 landowners to more fully and effectively use 750 of the 793 acres of flood plain land in the area protected by the structures. The opportunity for improved use and management of about 100 acres of adjacent land will also be realized. It will permit the use of improved crop varieties, more timely seeding and harvesting operations, and other cultural practices which tend to improve operating efficiency and farm income.

Projected land use changes can be seen in Table VIII. Cropland will decrease faster than if the project was not carried out. This acceleration is primarily due to an increased production capability of the protected flood plain area, a 454 acre loss to the reservoirs and structure sites, and a more rapid increase in urban and built-up areas. Pasture and forest acres will remain essentially the same. The urban and miscellaneous areas will increase more rapidly with the project than is projected without.

TABLE VIII

Projected Watershed Land Use - 1980

Land Use	Flood Plain Acres		Upland Acres		Total Acres	
	With Project	Without Project	With Project	Without Project	With Proj.	Without Project
Cropland	1,095	1,179	2,958	3,167	4,053	4,346
Pasture	775	1,118	8,723	8,476	9,498	9,594
Forest	344	486	44,167	44,149	44,511	44,635
Urban & Buildup	166	10	1,121	1,177	1,287	1,187
Miscellaneous 1/	463	50	688	688	1,151	738
Total	2,843	2,843	57,657	57,657	60,500	60,500

1/ Miscellaneous includes road rights-of-way, flood pool areas, area for dams and spillways and a few miscellaneous unclassified areas.

Application of the conservation land treatment measures discussed in the Planned Project section will reduce erosion within the installation period of the project, by approximately 14 percent, to about 6 tons per acre per year. All measures will be developed as an integral part of each operators total land use and management plan in line with the influencing community development plans. These plans will take into account site conditions, soil capability and conditions, local surrounding esthetic values and other conditions necessary to guide each acre of land to the use determined to be best at this period in time and step of social development. Thus, the final effort is to achieve the best possible combination of landowner objectives, community development objectives, maintaining a quality soil and water resource base and a quality environment.

The slope of flood plain cropland averages from 1 - 5 percent and produces an average of 3.5 tons of sediment per acre per year. Upland cropping areas range from 10 to 20 percent slope and produce 28 tons of sediment per acre per year. Erosion from grassland is less than 3 tons per acre annually due to the improved density of vegetative cover and increased organic matter build-up on the soil surface.

It was determined during the project investigation that the natural productive capacity of two acres of well-managed flood plain cropland is at least equal to three acres of well-managed upland cropped acres in this area. This means that by reducing the flooding problems, management efficiency can improve with a resulting increase in production. Therefore, less acreage will be needed for cultivated crops and more of the upland crop acreage can be used for grassland and forest, reducing the erosion problem.

Sediment damages to flood plains will be reduced by 84 percent and downstream sediment damages by 51 percent. Flood plain scour will be reduced by 70 percent.

Development of operation and land use plans as a part of this project will serve as one of the tools for landowners to take into account wildlife resources, esthetic and environmental values. Crop residues and grain and seed shattered during harvest will provide food and cover for almost all forms of wildlife found in the area. Field border and odd-shaped area plantings of herbaceous and shrubby plants as a part of operation and management plans will add to existing area of wildlife food and cover.

Improved management practices made possible by this project are expected to increase by about 110 the number of farms with annual gross sales greater than $5,000. Presently about 280 farms do not have sales of at least this amount. Employment opportunities will improve for about 100 local agricultural workers with an increased potential for off-farm employment. It is anticipated that the income of operators of small family-type and part-time farms will be materially improved.

The frequency of beginning flood damage will be reduced from the once in two-years to once in five years. The point of beginning damage is that elevation above which floodwaters cause economic losses.

The area flooded by the 100-year event, downstream from the planned floodwater retarding structures, will be reduced by 311 acres, from 793 to 482 acres; the 5-year event by 318 acres, from 369 acres to 51 acres; with flooding by the 2-year event reduced from 90 acres to 8 acres located in scattered areas of the lower elevations.

The 72 acres of flood plain in reaches A and D (see Appendix D, Project Map) will receive 100-year frequency protection. Forty of the 70 acres of flood plain in reach C will receive 100-year frequency protection, with a maximum flood depth of 0.6 feet anticipated on the remaining 30 acres. Fifty-four of the 73 acres in reach G will receive 100-year frequency protection, with a maximum depth of 1.7 feet on the remaining 19 acres. An estimated 500 acres of agricultural flood plain on the main stem of Buffalo River downstream from the project area will be affected.

Effects of this project will extend beyond the limits of the watershed area. The estimated sediment yield at the mouth of the watershed under present conditions is approximately 43,700 tons per year. Future sediment yield with the project installed would be 21,400 tons per year. This would be an expected sediment reduction of about 22,000 tons annually. The estimated reduction will affect sediment removal costs and ship channel maintenance in the navigable waters of the James River which include the port of Hampton Roads and 104 river miles to the head of navigation at Richmond city locks.

According to Dr. C. H. Wadleigh, 1/ "Sediments constitute the main burden of pollutants in our surface waters.

"Committee Print No. 9 of the Senate Select Committee on Water Resources states that 'Rough estimate of the suspended solids loadings reaching the Nation's streams from surface runoff shows these to be at least 700 times the loadings caused by sewage discharge.'

"Carl Brown 2/ 'estimated that only about 1 ton in 4 of the silt produced by erosion from our watersheds ever reaches the ocean.'" Thus, 3 out of every 4 tons end up as sediment in our rivers, estuaries and flood plains.

1/ Wadleigh, C. H., 1968, Land Run-Off in Relation to Water Contamination. Presented at the Annual Meeting of Virginia Soil Conservation Districts, Richmond, Virginia, January 9, 1968.

2/ Carl Brown. Proceedings, The National Conference on Water Pollution, December 12-14, 1960, Washington, D. C.

Dr. Wadleigh adds, "Aside from filling stream channels and reservoirs, suspended sediment makes necessary expensive additional treatment processes for municipal and industrial water supplies. Sediment impairs oxidation of organic pollutants in streams. They cause erosion of power turbines, pumping equipment, and other structures. They reduce fish and shell fish population by blanketing the nest, spawn, and food supplies."

Studies by the Federal Water Pollution Control Administration and the Bureau of Sport Fisheries and Wildlife show that the success of our fisheries industry, sport and commercial, is largely dependent on the water quality and food production in estuaries and rivers. Many commercially and recreationally important fishes require estuarine nurture for survival to maturity. For example, at some time in their life histories, shad, striped bass, herring, perch, flounder, sea trout, spot, drum, snapper and blue fish live in the estuaries. In addition, estuaries provide for production of clams, oysters and crabs and the estuarial mud flats support several intertidal species of crustacea and provide winter food and resting areas for wild ducks and geese.

Sedimentation, including material moved along the streambed, is universally recognized as harmful to stream biota in many ways.1/ (Other effects which include damages or benefits to flood plains, and the cultures thereon, associated with sediment laden floodwaters are covered on page 26.)

Sedimentation affects light penetration of water, inhibits growth of stream bottom organism used as food, affects oxygenation of waters, covers spawning and nesting areas, covers fish and other eggs, adversely affects fish gills, and causes other damages or reactions which affect the welfare of associated flora and fauna.

It is difficult to assign monetary values to all the above damaging effects. However, a monetary value of $40,000 annually has been assigned to the reduction in downstream sediment damages, based on a proxy value of $1.82 per ton to the reduction of 22,000 tons of sediment leaving the watershed.

The installation of the six P. L. 566 projects, along with the Buffalo River Project, has only slight effect on the flows of the James River estuary. Since the combined drainage area of these seven projects is about 766 square miles out of a total of 10,062 square miles at Hampton Roads, the impact is not significant. The structures are designed to sharply reduce peak flows, and also to increase the base flow for a period of 5 to 10 days following any storm. The analysis made during the preparation of the James River Basin Study indicated that 126 potential P. L. 566 structures would modify the discharge at any time

1/ Hollis, E. G., J. G. Boone, C. R. DeRose, G. J. Murphy, 1964. A Literature Review of the Effect of Turbidity and Siltation on Aquatic Life. Staff Report Department of Chesapeake Bay Affairs, Annapolis, Maryland.

during any event less than 1 percent. On the James River near Scottsville low flows will not be affected.

Installation of this project will make a safe public water supply service available to most of the residents of the watershed. This development as a major segment of a county-wide water system will supply the major portion of the needs of the people expected to be living in the county by the year 2000. (See Table VII).

A mining and pigment processing operation employing 400 people in the adjacent Tye River watershed in Nelson County was recently closed due to pollution and other environmental problems. Some of these people live in the Buffalo River watershed. The water storage and flood protection provided by this project will create conditions which are expected to help offset this employment loss.

Installation of the project measures will provide 30 to 40 jobs for about 6 years. Operation and maintenance of the project measures will provide 10 to 20 permanent jobs. Commercial and industrial expansion is expected to create 300 to 400 jobs by 1980. Another 100 to 200 support type and service jobs may also be created as a result of the project.

With the project installed, a reduction of 787 acres of cropland, (primarily hay), 182 acres of pasture, and 259 acres of forest land is expected to occur throughout the watershed. A corresponding increase of 585 acres of urban and built-up area is expected while miscellaneous land uses (water, flood pools, dams, idle areas, roads, wildlife land, etc.) are expected to increase by 643 acres. Three hundred acres of wildlife habitat management is planned as land treatment. It is very difficult to partition changes in wildlife habitat brought about by these land use changes from the changes that would take place without the project. (See Table VIII). However, in either case reductions of cropland, pastureland and forest land will take place which, in turn, will bring about a reduction in the quantity of wildlife habitat.

The wildlife habitat throughout the watershed will be maintained and, in many cases, improved by the development of conservation practices through the land treatment program. Contour farming on slopes, with alternate bands of a clean-tilled crop (such as corn) and a close growing grass or legume, provides edges where wildlife food and cover are close together. Crop residue management leaving stubble and other residue on the field surface, furnishes waste grain and seeds for various birds. Grassed waterways and critical area plantings will provide legumes and grasses whose seed and foliage furnish food and cover. They also help to move water down slopes and reduce sediment in streams, ponds and lakes. Tree planting and forest management promotes long-term food production and cover in forest land areas.

Many studies have shown the advantages of soil conservation practices to wildlife. Dambach and Good 1/ found that a stripcropped field of corn, grain and meadow (grass) harbors about twice the number of ground-nesting birds as a solid field of grass. Edward H. Graham 2/ in his book documented, through experience and many references, the value of conservation land treatment to wildlife habitat. Trippensee 3/ says, "sheet erosion, which gradually removes topsoil and lowers fertility, though less spectacular than gully erosion, can be equally insidious in that cover quality and volume production of food materials become progressively less satisfactory. Control measures take various forms that benefit wildlife directly, not only by arresting the process of erosion, but also, by creating new cover and new food sources."

Gabrielsen 4/ says, "The greatest present opportunity for environmental development is found in general farming districts in which crop rotation is practiced and on pasture and grazing lands. In addition to the biological factors, there are other elements involved when the wildlife managers invade agricultural lands with wildlife habitat development included as a part of the farm pattern. Naturally, the changes proposed must be fitted into existing agricultural use. Soil Conservation District organizations offer the best opportunity since they are already helping to rearrange fields, the distribution of the crops and the kind of crops to be grown. As these (conservation) programs extend to individual farms, the wildlife opportunity will be correspondingly greater." The land treatment phase of this project accelerates conservation plan development and application as referred to by Gabrielsen.

Observations on completed watershed projects in Georgia by Grizzel 5/ point out that egrets, herons, ibises and swallows were attracted to the water impoundments created in areas where these birds were not present before.

Land Use and Wildlife Resources 6/ points out the benefit of conservation farming practices to wildlife. Beneficial farming methods cited

1/ Damback, Charles A. and E. E. Good, 1940, The Effect of Certain Land Use Practices on Populations of Breeding Birds in Southeastern Ohio. Journal of Wildlife Management, 4:63-76.
2/ Graham, E. H., 1947, The Land and Wildlife. Oxford University Press, New York.
3/ Trippensee, R. E., 1948, Wildlife Management. McGraw-Hill Book Company, New York, Toronto, London.
4/ Gabrielsen, Ira N., 1951, Wildlife Management. The MacMillian Company, New York.
5/ Grizzel, Ray, 1958, Proceedings of Southeastern Conference of Game and Fish Commissioners, Louisville, Kentucky.
6/ Anonymous, 1970, Land Use and Wildlife Resources. National Academy of Sciences, Washington, D. C.

are rotations that include grass-legume meadows, liming and fertilizing, stripcropping, cover crops, stubble-mulching, pasture improvement and proper grazing. This publication goes on to say that it is evident that nearly all of the practices desirable for the production of wild creatures are either necessary for good land management or at least not inimical to it.

Durward L. Allen, et al. 1/ reports that farms improved with modern cropping and soil building practices produced more quail than unimproved lands, while cottontail rabbit populations were not increased. Conservation farms supported a greater number of species of breeding songbirds, while a check farm had a consistently higher density of birds.

Public ownership of the four dams and adjacent areas, allowing public access for fishing will accommodate about 36,550 visitors annually. The reservoirs will provide additional resting areas for migrating waterfowl.

It is anticipated that the owner-occupied dwelling to be acquired in connection with the construction of dam 1B will be replaced with a new safe and sanitary dwelling on the owner's remaining land which will contain more modern conveniences than the dwelling presently occupied. Other replacement dwellings will be generally comparable to the rental dwellings in the area and at least meet the "decent, safe, and sanitary" requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

The hazard of loss of life, except from unusually rare floods such as Hurricane Camille, will be virtually eliminated. The recurrence of Hurricane Camille would be expected to produce 1.0 to 1.5 million dollars damage to existing properties without the proposed project. With the project installed, and considering the projected development in the flood plain, damages from a storm of this magnitude would be expected to be about $500,000.

All streams are not affected in the same manner by turbidity, silt and sediment. At the best, predictions of the impact of turbidity, silt and sediment reduction or temporary increases will be general estimates. For existing conditions, sediment yield at each structure site is estimated to be: Site 1B, 20,565; Site 2, 7,646; Site 3, 8,083; and Site 4, 6,766 tons per year. Converted to milligrams per second, this sediment yield amounts to 0.96, 1.26, 1.83 and 0.94, respectively for the sites. The average stream discharge is 21.6, 6.1, 4.5 and 7.3 cfs, respectively at sites 1B, 2, 3 and 4; converted to liters per second these discharges amount to about 612, 173, 127 and 206, respectively.

1/ Allen, Durward L., W. Rosene, Jr., Oscar Warbach, 1951, Wildlife Investigations on Agricultural Lands. USDI, F & W Service, Patuxent Research Refuge, Progress Report, January 1951.

The following table shows the estimated average sediment concentration at sites for existing, construction and future conditions. The sediment concentration is assumed to be equal to turbidity in the table:

TABLE IX

ESTIMATED SEDIMENT CONCENTRATION
(TURBIDITY) AT BUFFALO RIVER WATERSHED SITES

Site Number:	Present Conditions	Dam Construction Period	Future Condition Project Installed
	Parts per Million		
1B	960	1,034	80
2	1,260	1,420	105
3	1,830	2,056	116
4	940	1,060	81

Herbert and Merkens 1/ demonstrated that long-term exposure of rainbow trout to 100-200 ppm. of kaolin and diatomaceous earth could be harmful, and that a high percentage of the fish died at 270 to 810 ppm. However, Griffin 2/ reported on experiments where trout and salmon fingerlings fed and grew well in muddy water carrying a constant silt load of 300 to 750 ppm. Ward 3/ reported that turbidity as high as 245 units is not harmful to fish. Stuart 4/ concluded that silt is not very dangerous in the normal streams if the excess occurs only at intervals. Ward 3/ agreed that silt deposits may smother spawning beds, but believes that silt is not always inimical to fish life, and that at times it may be beneficial.

Reinhart and Lull 5/ found that turbidity resulting from a clear-cut watershed faded rapidly. During logging operations, turbidities averaged 490 ppm. The first year after logging ceased, the turbidity declined to 38 ppm. By the second year it was reduced to 1 ppm.

1/ Herbert, D. W. M. and G. E. Merkens, 1961. The Effects of Suspended Mineral Solids on the Survival of Trout. International Journal of Air and Water Pollution, 5:46.
2/ Griffin, L. E., 1938. Experiments on Tolerance of Young Trout and Salmon for Suspended Sediment in Water. Oregon Dept. Geo. and Min. Indus., Bull. No. 10.
3/ Ward, H. B., 1938. Placer Mining on the Rogue River, Oregon and Its Relation to the Fish and Fishing in That Stream. Oregon Dept. Geo. and Min. Indus., Bull. No. 10.
4/ Stuart, T. A., 1953. Spawning Migration, Reproduction and Young Stages of Loch Trout (Salmotrutta L.). Scottish Home Dept., Freshwater and Salmon Fishery Res. No. 5.
5/ Reinhart, K. G. and H. W. Lull, 1965. Manipulating Forests for Water. American Forest.

Current studies by the U.S. Geological Survey (Reed) 1/ on Bixler Run, Perry County, Pennsylvania, demonstrated that trout streams can recover from the most severe damages. In 1957, a section of Bixler Run was straightened and realigned to remove meanders. This resulted in a temporary heavy silt load at the gaging station just below the work site. Since then, the stream has gradually recut its way back to its original channel. Despite these dramatic changes, Bixler Run remains an excellent trout stream. No measurable amounts of sediment have been deposited on the stream bottom, and no significant changes have occurred among the benthic organisms during the course of the study. Furthermore, no noticeable change has occurred in the relatively high trout population in the vicinity of the gaging station during the study period. The stream is stocked by 2/ the Pennsylvania Fish Commission.

Records show that Bixler Run normally carries a heavy sediment concentration.3/ The gaging station near Loysville recorded sediment concentrations ranging from 460 to 986 ppm., with a total load of 1,010.1 tons per year, during the period 1965-1966. During the period 1964-1965, the total annual load was 534.1 tons;4/ and on ten days from December to September, recorded sediment concentrations ranged from a low of 140 ppm. to a high of 1,100 ppm.

Reed 5/ studied the effects of road and pond construction on a stream west of Enola, Pennsylvania. Base-flow sediment increased during construction from the expected 6 ppm., to an average of 35 ppm. The base-flow sediment concentration at the gage in December was twice what would have been expected under normal conditions. Sediment discharge, attributed to construction, was 55 tons. This was 66 percent of the annual amount expected from the basin under normal conditions. Base-flow turbidity increased from an average of 6 J.T.U. 6/ prior to construction to an average of 33 J.T.U. Spring flows in 1971 flushed the accumulated sediment from the pond and the stream; and turbidity and sediment concentrations have returned to their preconstruction values.

1/ Reed, L. A., 1971. Unpublished Data. U.S. Geological Survey, Harrisburg.
2/ Anonymous, 1971. Pennsylvania Trout Waters, Pennsylvania Fish Commission, Harrisburg.
3/ Anonymous, 1966. Water Resources Data for Pennsylvania, Part 2, Water Quality Records, USDI, Geological Survey, Philadelphia.
4/ Anonymous, 1965. Water Resources Data for Pennsylvania, Part 2, Water Quality Records, USDI, Geological Survey, Philadelphia.
5/ Reed, L. A., 1971. Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pa., U.S. Geological Survey, Open File Report. Harrisburg.
6/ Jackson Turbidity Unit.

Ellis, et al. 1/ stated that it is not possible to set standards for minimal turbidity or loads of suspended matter which fish will tolerate. There are too many factors to be considered in evaluating the detrimental action of suspended matter. And then, the more serious hazards develop slowly and insidiously.

For example, Ellis 1/ reported that the water from Nesqually Glacier on Mt. Rainier was muddy and carried from 0.1 to 0.2 percent of suspended matter by volume which settled out in one hour, and had a residual turbidity of 150-170 A.P.H.A. 2/ units. Yet this stream supported a good trout population under these conditions. Other glacial streams also supported good trout populations where suspended matter which would settle out in one hour was 0.15 percent by volume and the residual turbidity was 110 A.P.H.A. units.

Ellis also pointed out that Whitewood Creek in South Dakota had no trout at points where it carried over 22 percent by volume of solids which would settle out in one hour and the residual turbidity was over 48,400 A.P.H.A. units. Trout reappeared when the suspended matter settling out in one hour had dropped to approximately 3 percent by volume and the residual turbidity was reduced to 720 A.P.H.A. units.

Oklahoma 3/ suggested that turbidity criteria for recreation, fish, and wildlife be set at 2,000 ppm. Ellis 4/ 5/ recommended that stream bottoms should not be blanketed to a depth of more than one-quarter of an inch by sedimentary deposits in order to prevent destruction of bottom fauna.

Water Quality Criteria for European Freshwater Fish 6/ indicates that there is no evidence that concentrations of suspended solids less than 25 ppm., have any harmful effect on fisheries, and that good or moderate fisheries can be maintained in waters that normally contain 25 to 80 ppm. suspended solids. It points out that waters normally containing 80 to 400 ppm., suspended solids are unlikely to support good freshwater fisheries.

1/ Ellis, M. M., B. A. Westfall and M. D. Ellis, 1946. Determination of Water Quality. U.S. Fish and Wildlife Service, Research Report No. 9.
2/ American Public Health Association.
3/ Anonymous. Water Quality Criteria for the State of Oklahoma. Bureau of Water Resources Research, University of Oklahoma, Norman.
4/ Ellis, M. M., 1935. Measuring Pollution in Fresh Water Streams. Trans. Amer. Fish. Soc., 65:240.
5/ Ellis, M. M., 1944. Water Purity Standards for Freshwater Fishes. U.S. Fish and Wildlife Service, Special Scientific Report No. 2.
6/ Anonymous, 1964. Water Quality Criteria for European Freshwater Fish. Report on Finely Divided Solids and Inland Fisheries. European Inland Fisheries Advisory Committee. Tech. Paper No. 1.

A Montana study 1/ describes how the sediment load in a trout stream affects trout populations. Five sampling stations, each three miles apart, were established in a stream. Median values for the monthly sediment concentrations starting at the upstream Station I were 18 ppm.; 79 ppm., at II; 167 ppm., at III; 186 ppm., at IV; and 319 ppm., at Station V. Trout captured by electrofishing decreased from a high average of 216 at Station I to a low of 6 at Station V. Rough fish at Station I numbered 7, and at Station V, 378 were caught.

The report of the Committee on Water Quality Criteria 2/ recommends "turbidity in the receiving water due to a discharge should not exceed 50 J.T.U. in warm water streams or 10 J.T.U. in cold water streams."

Construction of the dams will create turbidity in Buffalo River, which will temporarily reduce fish food and fish growth in the river below. Construction during the dry period, silt trap basins, and seeding of disturbed areas will help keep turbidity to a minimum. The project will produce silt and sediment, but this will be a temporary situation. It will not create any long-term or permanent damage to the fishery. Some fish mortality may occur. In the long run, the program will actually improve fish habitat through the reduction of sediment. There will be a loss of habitat for some species of wildlife and a corresponding gain of habitat for other species. Terrestrial forms will lose use of the 413 acres inundated but these acres will become available to fish, amphibians, turtles, waterfowl, shorebirds, and other forms that require water areas.

The structural measures will affect wildlife habitat on a total of 719 acres. Existing land use is 488 acres of cropland, 164 acres of pasture, and 67 acres of forest land, idle and miscellaneous land type.

Following construction, there will be 413 acres of permanent water, 41 acres of grasses and legumes, and 265 acres of weeds, shrubs and trees periodically flooded.

The 719 acres occur as four different locations in the watershed and are separated as follows:

Site 1B	- 296 acres	Site 3	- 96 acres
Site 2	- 88 acres	Site 4	- 239 acres

1/ Peters, John D., 1967. Effects on a Trout Stream of Sediment from Agricultural Practices. J. Wildlife Mgmt. 31(4):805-812.
2/ Anonymous. 1968. Water Quality Criteria. Report of the National Technical Advisory Committee to the Secretary of The Interior. FWPCA. Washington, D. C.

Birds and the larger mammals will move from the inundated acres to the surrounding land as construction progresses over six years. The displacement of these wildlife species from 413 acres (161 acres, 36 acres, 41 acres, 175 acres) is not expected to cause undue crowding on the surrounding land since 13 miles of water - terrestrial edge will be created, 41 acres of high quality grass and legumes will be established and maintained on the dams, spillways, and construction areas and 265 acres of miscellaneous shrubs, weeds and grasses will remain in the flood pool areas.

TABLE X

WILDLIFE - LAND USE CHANGE

Land Type	Existing	Post Project	Diff.	Characteristic Wildlife
Cropland	488	0	-488	1/
Pastureland (Grasses & Legumes)	164	41	-123	2/
Miscellaneous (Forest land, shrubs, weeds)	67	265	+198	3/
Water	0	413	+413	4/

1/ Blackbirds, doves, bobwhite quail, sparrows, finches, small mammals.
2/ Field sparrows, bobwhite quail, cottontails, whitetail deer.
3/ Bobwhite quail, sparrows, cottontails, whitetail deer, skunks, warblers, ruffed grouse, small mammals.
4/ Turtles, amphibians, waterfowl, swallows.

The primary change will be to 5 miles of stream with approximately 10 surface acres to 413 acres of lake-like waters with approximately 13 miles of shoreline. It is calculated there will be at least a forty fold increase in fish mass, most of which will be available to fishermen. However, it is anticipated that populations of 12 species of fish will be expanded, 4 eliminated, and 3 species reduced to the point of survival (Table XI) in the 5 miles of stream inundated.

An economic summary of this project is described in table 6 of the watershed work plan which is attached as Appendix A to this statement.

TABLE XI

Fish Species Known in Buffalo River
and Expected Impact Due to Impoundment

Common Name	Scientific Name	Expected Impact
Bluegill	*Lepomis macrochirus*	S+
Pumpkinseed	*Lepomis gibbosus*	S+
Redbreast	*Lepomis auritus*	S or S+
Common shiner	*Notropis cornutus*	S or E
Creek chubsucker	*Erimyzon oblongus*	E
Brown bullhead	*Ictalurus nebulosus*	S+
Carp	*Cyprinus carpio*	S+
Chain pickerel	*Esox niger*	S+
Bluntnose minnow	*Pimephales notatus*	S+
Smallmouth bass	*Micropterus dolomieui*	S or E
Brook trout	*Salvelinus fontinalis*	E
White sucker	*Catostomus commersoni*	S+
Bluehead Chub	*Nocamis leptocephala*	E
Satinfin shiner	*Notropis analostanus*	S+
Swallowtail shiner	*Notropis procne*	S or E
Johnny darter	*Etheostoma nigrum*	S or S+
Margined madtom	*Noturus insignis*	S+
Northern hog sucker	*Hypentelium nigricans*	S+
Fantail darter	*Etheostoma flabellare*	E

S = Survival; S+ = possible expansion; E = extinction or reduction within impoundment

Sources: Dr. Robert D. Ross and George M. Simmons, Virginia Polytechnic Institute and State University, 1973; and Dr. Robert E. Jenkins, Roanoke College, Salem, Virginia, 1973.

3. Favorable Environmental Effects

a. Reduce floodwater and sediment damages to 38 farms, 4 commercial and industrial businesses and property owned by the town of Amherst. This will allow more efficient and effective use of 750 acres of land contributing to the development of this segment of the James River Basin.

b. Reduce the sediment leaving the watershed by about 22,000 tons annually.

c. Reduce erosion by approximately 14 percent, to about 6 tons per acre per year by application of the planned conservation land treatment measures.

d. Reduce sediment damages to flood plains by 84 percent, downstream sediment damages by 51 percent, and flood plain scour by 70 percent.

e. The residents in and near the watershed will encounter fewer blocked roads.

f. Increase by 110 the number of farms with annual gross sales of more than $5,000.

g. Beginning flood frequency will be reduced from about once in two years to once in five years.

h. Provide improved fish and wildlife habitat by the creation of 4 lakes with 413 surface acres of water suitable for fish production and resting areas for local and migrating waterfowl.

i. Provide an estimated 36,550 user days of fishing opportunity in the created lakes.

j. Provide 8.2 million gallons per day of high quality water as a major segment of a county-wide water system.

k. Create employment opportunities in the area.

l. Provide improved wildlife food and cover on 300 acres of upland.

m. The hazard of possible loss of life from unusual and unexpected floods will be virtually eliminated.

4. Adverse Environmental Effects Which Cannot be Avoided

a. Agricultural and incidental wildlife use will be lost on 293 acres of cropland, 96 acres of pasture, and 65 acres of farmsteads and woodlots by the construction of the 4 dams, spillways and reservoirs.

b. About 5 miles of potential stream fishery will be lost on posted land available to the landowners involved.

c. Relocation of personal property into a new home, to be built on the owner's remaining land, from one owner-occupied dwelling will be necessary. Relocation of four families from rented dwellings will be required. Two mobile homes will be moved to new locations.

d. Agricultural and incidental wildlife use of 179 acres of cropland, 62 acres of pasture and 24 acres of farmstead lots and forests will be periodically interrupted by floodwater in the detention pools of the 4 structures.

e. Construction of the dams will temporarily increase turbidity in Buffalo River. Construction during dry periods, sediment trapping basins, and prompt seeding of disturbed areas will minimize the adverse effects.

f. There will be a loss of habitat for some species of wildlife but this will be partially overcome by a corresponding gain of habitat for other species. Terrestrial forms will lose use of less than 1 percent of the watershed; whereas, 413 acres will become available to fish, amphibians, turtles, waterfowl, shorebirds, and other forms that require water areas.

Alternatives

a. Accelerated Land Treatment Only - This alternative consists of land use adjustments and installation of needed conservation land treatment measures. It would involve applying the needed conservation practices already identified and described in the Planned Project section under Land Treatment. Wildlife food and cover would be furnished from field borders, scattered areas of wildlife plantings and residual grains remaining after harvesting.

The total estimated cost of this alternative would be $400,000.

The effectiveness of this alternative in reducing soil erosion and the resulting sedimentation should be essentially the same as for land treatment measures in the proposed project; a 14 percent reduction at the end of the project installation period.

Improved water infiltration into the soil due to land treatment measures will have a measurable effect on the small more frequent storms. It would not have a noticeable effect on a storm of a 10-year frequency or greater. Floodwater damage reduction is estimated to be 5 percent.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

This alternative would essentially meet the sponsors' objectives related to land treatment. Flood damages to agricultural interests, roads, bridges, and other flood plain improvements would continue. The water supply objectives of the sponsors would not be met. There would be a net increase in cultivated crops on upland areas with this alternative (See Table VIII). Growth of the area could not be accomplished at the anticipated rate due to unavailability of municipal and industrial water supply storage.

The 454 acres of land involved in structures and water areas would remain as crop, pasture and forest land; with incidental wildlife uses. Five miles of stream would be retained and no relocation of people or personal property necessary. Increased turbidity due to construction of the dams would not occur.

b. Land Treatment and Channel Work - This alternative consists of land treatment and channel enlargement. The land treatment phase, its composition, its costs, and its effects are described above. The channel work would consist of 15 miles of channel enlargement and the protection of that channel from erosion by rock riprap and vegetative cover. The spoil from channel excavation would be spread through cropland and pasture and piled through forest land. Construction from one side would

be employed when practical. Selected trees and other vegetation would be left on the opposite side. The channel banks above the riprap and a 30-foot right-of-way for permanent maintenance would be seeded to adapted grasses and shrubs to provide ground cover, minimize erosion and provide food and cover for wildlife. The channel would be fenced for protection. Five bridges and their approaches would be enlarged and raised.

Channel construction would require 150 acres of flood plain land now in crops, pasture, forest land, channel and fringe areas. The 30-foot maintenance right-of-way will require an additional 54 acres; making a total of 204 acres needed for land rights.

The alternative would be designed to provide flood protection from a 5-year frequency growing season flood for agricultural lands and protection from a 10-year frequency annual flood for the roads and bridges and other flood plain improvements.

The estimated cost of this alternative would be approximately $3 million.

This alternative would reduce the flooding of cropland and pasture to a level that would allow agricultural land use and management practices comparable to those for planned project on the area not required for channel enlargement and the maintenance right-of-way.

Channel construction would require 55 acres of land now occupied by channel banks and forest areas, 104 acres in crops and pasture and 45 acres in various miscellaneous uses.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

The channel banks and fringe areas rehabilitated after Hurricane Camille were seeded to adapted grasses and other plants; such as, fescue and sericea lespedeza. Very little brush or tree cover remained after that flood. Since fish and wildlife values that may have existed prior to Camille were largely destroyed by that flood and not enough time has passed for rehabilitation even though the scars have been healed mechanically and seeded; the channel work of this alternative would prolong the rehabilitation process. Aquatic life would be affected during the construction period. Sediment effects downstream from the construction area would adversely affect aquatic life and water quality for the construction period and for as many as 3 years after construction. Following construction, stream sediment loads would return to levels similar to those described in the Land Treatment alternative above.

Water supply objectives of the sponsors could not be met with this alternative. Agricultural lands, fixed improvements, roads, etc. would

continue to be susceptible to flooding from floods greater than the design basis for this alternative. Because of urbanizing processes it could be expected that some of the flood plain would be used for purposes not consistent with flood threats.

The sponsors' planned level of use and management of the flood plain lands could not be met by this alternative.

This alternative would not require as much land, thus, some of the unfavorable impacts associated with the reservoir sites would be avoided. The 5 miles of stream channel in the reservoir areas would not be inundated and converted to lake-type areas. Four families in rented dwellings and one in an owner-occupied dwelling and two mobile homes would not have to be relocated.

c. Land Treatment and Single-Purpose Water Supply - This alternative would include the installation of the accelerated land treatment program described in alternative "a", and separate development of a water supply system. A structure could be developed on Buffalo River at the location of damsite 1B to provide the projected needs of 8 million gallons per day. This would require the purchase of an estimated 300 acres of land, relocation of 3 families in rented dwellings and 1 family in an owner-occupied residence. About 2 miles of stream channel would be inundated and a reservoir of about 275 acres would be created. The water would be delivered to the point of need by gravity flow.

The James River could be used as a source of water instead of Buffalo River. This would require development of a raw water intake treatment plant and pumping station near Elon. Twenty miles of 48 to 60 inch high pressure transmission line would be required to deliver the water to the point of need. Adequate pumping facilities for a 300-foot vertical lift to assure an uninterrupted supply of 8 million gallons per day to the point of need would be required.

The estimated cost of a single purpose water supply reservoir on Buffalo River was estimated by the sponsors' consultants at $1.4 million in 1968. The cost of securing the water from the James River was estimated at $2.6 million in 1968 in addition to the pumping and increased treatment costs. The pumping cost from the James River to the point of need is estimated at $40,000 annually. Chemicals and supplies for adequately treating water from Buffalo River are estimated to cost about $45,250 annually. The cost of these materials to treat 8 million gallons per day from the James River is estimated at $90,500 annually.

This alternative would provide the same reduction in sheet erosion on the uplands as the planned project. With a water supply structure on

Buffalo River, the downstream sediment damages would be reduced about 25 percent due to land treatment and trapped sediment. With the James River used as the source of raw water, the effectiveness of this alternative in reducing floodwater and sediment damages is described in alternative "a". The water supply objectives of the sponsors could be met by this alternative.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

The flood prevention objectives of the sponsors would not be met with this alternative.

One family living in a rented residence and two living in mobile homes would not be affected by this alternative with Buffalo River as the source of raw water. Use of the James River as the source of raw water would eliminate the necessity of constructing a reservoir on Buffalo River; providing the same project effects as alternative "a".

d. Land Treatment, Single-Purpose Water Supply Structure and Flood Plain Zoning - For this alternative the land treatment program described in alternative "a" would be installed. The 100-year flood plain would be zoned for uses compatible with the flood hazard and a single purpose water supply structure built.

Total costs are estimated to be $1,835,000.

Essentially the same land treatment benefits would result from this alternative as described in alternative "a", with the exception that most cultivated crops now on the flood plain would be moved to the more erodible uplands due to the flood hazard. Downstream sediment damages would be reduced about 25 percent by land treatment and sediment trapped in the single purpose reservoir. Existing improvements would remain subject to flood damages. New developments in the flood plain would be limited to the type compatible with the flood hazard. Wildlife conditions would be essentially the same as in the land treatment alternative, with some waterfowl resting area furnished by the reservoir pool. Also a warm water fishing habitat would be available from the water supply pool.

This alternative would meet the sponsors' objectives for water supply storage. The flood prevention objectives of the sponsors would not be met.

The adverse effects avoided by this alternative would be the same as those described in alternative "c" with a single purpose water supply structure on Buffalo River.

e. Land Treatment With Acquisition and Less Intensive Use of Flood Plain Lands - This alternative would provide for land treatment as described in alternative "a" and acquisition of the flood plain, removal of improvements, and regulation of its use.

The cost of this alternative is estimated to be between $2.5 and $3.0 million.

This alternative would require the purchase of the flood plain land, improvements, and the uneconomic remnants of upland of some farms and business properties involved. About 1,000 acres of upland would be changed from forest land and grassland to cultivated crops to offset flood plain areas removed from cultivation. The removal of commercial, industrial and agricultural operations from the flood plain would eliminate the present physical damages to these interests. Damages to roads, bridges and utilities could continue. Farm operating costs would increase, jeopardizing the farmers competitive position, and forcing a dependence on off-farm income to maintain some farm operations. In some instances purchase of the flood plain would make operating changes necessary which would not permit the continuation of the farm operation or business at that location. This would require the purchase of the entire property; relocation of the operation and families involved to other suitable properties as required by the Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970. This action would erode the local property tax base and cause social problems adversely affecting the local economy.

Fish and wildlife habitat conditions would be similar to alternative "a", with some cover loss on the upland and gain in the acquired area. An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

Purchase of these lands could make an area available for parks and other similar uses. This alternative would essentially meet the sponsors' objectives for land treatment.

The flood prevention and sediment reduction objectives of the sponsors would not be met. No provision would be made for the 8 million gallons per day municipal and industrial water needs.

The adverse effects avoided by this alternative would be the same as those in alternative "a".

f. Land Treatment and Flood Plain Zoning, Floodproofing and Flood Warning - For this alternative, the land treatment program would be installed as described in alternative "a"; the 100-year flood plain would be zoned; the water treatment plant, ready-mix concrete operation, several farmsteads, homes and miscellaneous buildings flood-proofed by dikes. A flood warning system would be dependent upon local radio and television stations. Cultivated crops would be removed from the flood plain and the agricultural use limited to pasture, hay and forest land which are less susceptible to flood damage.

The total cost of this alternative is estimated to be $1,100,000.

Buffalo River is an agricultural watershed. This alternative would eliminate most of the present physical damage to crops and flood plain improvements except roads, bridges and utilities. About 1,000 acres of upland would be changed from forest land and grassland to cultivated crops to offset flood plain areas taken out of cultivation. Erosion on cultivated upland averages about 28 tons per acre per year; while forest land and grassland average about 3 tons per acre per year. Erosion from cropland in the flood plain averages about three tons per acre per year. Thus, cropland moved from the flood plain to upland areas would have a corresponding effect on the erosion control problems in the watershed.

Increased infiltration due to land treatment measures would have a measurable effect on the small, frequent floods; but would not significantly affect storms of the 10-year frequency magnitude and greater. Stream channel conditions would be affected very little by the smaller storms, as is presently the case. Larger storms would continue to deposit debris, erode channel banks, scour the flood plain, and cause sedimentation problems.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

Development of a satisfactory flood warning system is not practical due to the hydrology of the watershed. Flood stages increase very rapidly following heavy rainfall. By the time a flood warning and evacuation advisory could be issued, the flood stage would have passed at many of the damage points; rendering this action ineffectual.

This alternative would basically meet the sponsors land treatment objectives, along with protection to existing properties. Damages to highways, communications and utilities would continue. No provision would be made to meet the 8 million gallon per day municipal and industrial water supply needs.

Adverse effect avoided related to structural measures would be the same as those in alternative "a".

g. Planned Project With Additional Structures - Other reservoir sites were studied for possible inclusion in the proposed project. Sites on Huff Creek and Tribulation Creek were located just above their confluence with Buffalo River. A site on Puppy Creek was located about one-fourth mile above Highway 717. Sites were also considered on Franklin and Beaver Creeks; but were eliminated due to obvious disruptions of people and farm operations and because of topographic features.

The total estimated cost of this alternative is $3,401,500.

The effects of structures 1B, 2, 3 and 4 are described in the planned project. Installation of the structure on Puppy Creek would require relocation of approximately one mile of Highway 610, disrupting traffic for about one year. Also two families would require relocation and several barns and other farm buildings would be affected. The structure on Huff Creek would affect flooding on only the two lower reaches (K and L); while the structure on Tribulation Creek would affect only the downstream reach (L) in the project area. Therefore, these two structures would have a very limited effect on flooding within the watershed. Seven miles of potential stream fishery would be inundated by the reservoir pools of this alternative. Construction of the sites in this alternative would cause a greater turbidity problem than construction of only sites 1B, 2, 3 and 4. It would require acquisition of 140 more acres for dams and reservoirs than would be necessary for the planned project.

This alternative would meet all the sponsors' objectives and extend the area benefited to an additional 50 acres of flood plain land.

It would not reduce any of the adverse effects of the proposed project.

h. No Project - The alternative of no project was considered. This would mean that structures would not be built and the accelerated land treatment program would not be installed. The sponsors' existing program of land treatment installation would continue at the present rate at a cost of approximately $450,000.

The eventual effectiveness of this alternative in reducing soil erosion would be essentially the same as alternative "a"; a 14 percent reduction. The landowners would have to delay installation of the land treatment measures until the staff available to the sponsors could provide them with adequate technical assistance. The time involved in this would be at least 40 years; whereas, the proposed project installation period is 6 years. No provisions for trapping sediment would be installed except for the areas above farm ponds.

Another effect of this alternative would be that about 1,000 acres of upland would be changed from forest land and grassland to cultivated crops. This would be necessary to offset flood plain areas which could not be used for cultivated crops because of the flood hazard. This eventuality would create more erosion and sediment problems. Erosion

on upland areas under cultivation is greater than on the flood plain even with all land adequately treated.

This alternative will result in further deterioration of resources, continued damage to cropland, pasture and flood plain but at a decreasing rate due to the continuation of the going program of land treatment measures.

Streamflow characteristics will be predictably subject to weather fluctuations. Debris from large storms will continue to cause channel blockage. Sediment will continue to damage flood plains, roads and bridges. Downstream sediment benefits due to trapped sediment will not be realized. Expansion of the area will not be accomplished at the anticipated rate due to the unavailability of municipal and industrial water supply.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 36,500 recreation visits annually would not be provided.

The sponsors' objectives will not be met in the following ways: land treatment will continue at the present rate, not accelerated; flood damages will continue; municipal and industrial water will not be available. Failure to install this project will result in foregoing net annual benefits of $102,299. (See Appendix A).

This alternative would avoid the loss of approximately 454 acres of cropland, pasture, forest land and wildlife areas that will be covered by water and involved in the structures of the proposed project. Five miles of stream channel will be retained. The increased turbidity associated with the construction activities will be avoided and no relocation of people or personal property will be necessary.

6. Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Proposed land treatment measures will be planned to meet the needs for sustained or increased productivity to provide needed food and other agricultural products. Continuing technical assistance programs will be periodically updated to provide the most recent recommendations for use and management of resources with due consideration for environmental and other values. The projected land use in this area is compatable with the projected needs anticipated by the Central Virginia Planning District Commission, Amherst County Planning Commission, and the town of Amherst Planning Commission.

Over 6,500 acres of the watershed is located in the George Washington National Forest, managed by the U.S. Forest Service. This area is expected to remain in public ownership and use. The four lakes associated with this project are included as a segment of Amherst County's public recreation and wildlife plan now in process of development. Most of the privately-owned lands of the steep upstream areas will remain in woods and generally serve as rural retreats for nearby urban residents.

One hundred sixty-three acres of National Forest land in this watershed are identified for exchange in the forest land adjustment plan. Location follows:

Structure No.	N.F. Acres for Exchange	Percent Drainage Area
2	46.5	1.05
3	117.0	3.66

Agriculture is expected to remain an important segment of the economy in the central and downstream areas of this watershed for the foreseeable future. Almost 75 percent of the farms have been classified as part-time operations for several years. This type of operation will probably increase somewhat in the future as off-farm employment opportunities improve in the area.

Installation of the Buffalo River watershed project will provide conditions whereby approximately 150 acres of bottom land near structure sites 1B, 2 and 3 can be developed for commercial or residential uses. This increase will result from the projected expansion of the Lynchburg Metropolitan area into Amherst County. In computing net benefits of this to the project,consideration was given to population projections for the area; the county's long-range land use plans for the Buffalo River drainage; the effects of the loss of present resource uses; development costs per acre for bottom land as compared to upland area development costs; increased erosion problems and control costs for nonagricultural development, operation and maintenance of upland areas; added road construction, operation and maintenance costs to service developed

areas; and the cost of extension of utilities into additional upland areas not now planned for nonagricultural uses.

No changes in land use are proposed which will significantly restrict options for future use or limit productivity. Structures, reservoirs and borrow areas will preclude optional use of one and two-tenths percent of the watershed area. On the remaining 98.8 percent, opportunities for productive use will be maintained or enhanced.

This plan provides a level of protection consistent with the needs and objectives of present and anticipated use of the flood plain lands. It provides protection to some of the most productive and easily managed land in the watershed and will aid in the orderly development of the natural resources of the area giving consideration to conservation and environmental measures to preserve the lands for use by future generations. The structural measures are evaluated for a 100-year period. At the end of this period the two multipurpose structures will continue to provide their designed level of flood protection; however, the municipal water supply storage available is expected to decrease as the sediment accumulates in the reservoirs. With respect to structures 2 and 3 several alternatives are available; such as:

a. Perform any necessary maintenance, clean out accumulated sediment, and continue to use the structure as in the past.

b. Demolish the structure and utilize the land for some other use.

c. Any other alternative that provides a useful purpose for the structure.

Due to its proximity to the Lynchburg metropolitan area, it is expected that areas adjacent to existing roads will develop for residential and commercial use as the metropolitan area expands. Measures in this project will provide the basis for additional soil and water conservation measures that may be found needed from time to time.

Six Public Law 566 watershed projects, comprising about 671 square miles total drainage area, have been approved for installation in the James River Basin. Installation is complete in three of the projects, one is substantially complete, with installation in the other two making good progress. Buffalo River and five of the approved projects are on tributaries of the James River upstream from Richmond. The other project is on a tributary of the Appomattox River which enters the James River estuary about 32 miles downstream from Richmond.

Individually the effect of these projects on flood stages on the main stem of the James River would be very difficult to assess. Taken collectively the structures proposed or installed in the five approved projects and Buffalo River control a drainage area of 238 square miles. This is about 3.5 percent of the drainage area of the James River above Richmond. Structures in these projects provide for 7,973 acre-feet of sediment storage, 41,301 acre-feet of floodwater detention storage

capacity and 5,849 acre-feet of municipal and industrial water storage for local use. The approved project on the tributary of the Appomattox River has been installed and provides 1,261 acre-feet of sediment storage and 9,982 acre-feet of floodwater detention storage capacity. The total drainage area controlled by these structures is 47.5 square miles.

Storage reserved for sediment in the structures built and proposed will reduce the amount of sediment entering the James River main channel and estuary by about 151,400 cubic yards per year. Current removal cost of this amount of sediment would be about $221,000 annually. Storage provided for floodwater detention storage capacity in these structures amounts to about 3.4 inches of runoff per acre controlled. Hydraulic studies of large drainage areas indicate that this type of structure will influence peak flow in the main channel generally in direct proportion to the percent of the total drainage area controlled. This would indicate a cumulative reduction of about 3.5 percent in peak flows in the James River at Richmond by the upstream watersheds, including Buffalo River.

The six approved projects and Buffalo River provide for improved conservation land treatment measures on about 766 square miles, or about 7.5 percent of the total James River Basin land area.

Secondary impacts resulting from the water supply development will be the sport fishery and associated recreation created. This will entail outlays for capital improvements such as access roads, parking areas, boat ramps, and restroom facilities. Since a new fishery is being created, a slight increase in sales of fishing licenses will occur, along with associated needs for small boats, fishing poles, lures and bait sales. An increase in vehicular traffic could be expected on secondary roads leading to the reservoirs during the fishing season, along with associated needs such as service stations and restaurants. Other closely related recreation pursuits would include canoeing, picnicking, photography, hiking, bird watching and nature study.

7. Irreversible and Irretrievable Commitments of Resources

Agricultural and incidental wildlife use will be eliminated from 413 acres to be inundated by the reservoirs at the 4 sites. Flooding of 265 acres in the detention pools will periodically interrupt agricultural and incidental wildlife use of these areas for limited periods. An estimated 5 miles of stream channel will be inundated by these reservoirs. About 20 acres inundated by the sediment and water supply pools and 30 acres in the detention pool areas are currently in brushy forest land and provide very limited economic benefits to the present operations.

8. Consultation with Appropriate Federal Agencies and Review by State and Local Agencies Developing and Enforcing Environmental Standards

a. General

Early local activity leading to the formation of the Buffalo River watershed committee was begun in 1964. This committee was given official status by the Amherst County Board of Supervisors and designated as their representative in the endeavor. The application for assistance in planning and carrying out watershed works of improvement under Public Law 566, 83rd Congress, as amended was filed by the Robert E. Lee Soil and Water Conservation District and Amherst County Board of Supervisors in April 1965. Letters of endorsement from the Retail Merchants Association of Amherst, Amherst County Farm Bureau, Amherst County Area Development Association, Amherst Lions Club, Temperance Ruritan Club, and Rotary Club of Amherst accompanied the application.

This application was approved by the Virginia Soil and Water Conservation Commission in August 1965 and assigned a planning priority in August 1967. Planning authority for development of a Watershed Work Plan was issued by the Administrator of the Soil Conservation Service in December 1967. At that time the following agencies were notified of planning intentions and requested to furnish any comments or suggestions they might have concerning the project: U.S. Army Corps of Engineers, Norfolk, Virginia, U.S. Geological Survey, U.S. Fish and Wildlife Service, Virginia Department of Conservation and Economic Development, Virginia State Water Control Board, Virginia Commission of Game and Inland Fisheries, Virginia State Board of Health, Virginia Division of Water Resources, Federal Water Pollution Control Administration, U.S. Forest Service, National Park Service, U.S. Bureau of Outdoor Recreation, Virginia Department of Highways, Virginia Division of Forestry, USDA, Agricultural Stabilization and Conservation Service, U.S. Bureau of Mines, USDA Farmers Home Administration, and Virginia Commission of Outdoor Recreation. All information received from these agencies was considered during the process of developing the work plan for this watershed.

No historical or archeological sites are known to be affected by this project. The Virginia Historic Landmarks Commission and the Virginia State Archeologist have been contacted and will be informed in the event any historical or archeological values are discovered or brought to the attention of the Soil Conservation Service.

Between October 1964 and December 1969, 55 news articles totaling 1,168 column inches and 2 pictures appeared in local newspapers relating to activities and information concerning the Buffalo River project. Pamphlets and letters were distributed to 72 clubs and civic organizations in the county to inform the general public of progress during the period that the work plan studies were being made. Seventy-two public meetings were sponsored by local Home Demonstration Clubs, Ruritan Clubs, Garden Clubs, Rescue Squads, Parent-Teacher Associations, American

Legion Posts, Lions Clubs and other civic groups to be sure that every person in the county would have the opportunity to express their feelings regarding the project.

b. Discussions and Disposition of Each Problem, Objection, or Issue Raised on the Environmental Statement by Federal, State and Local Agencies, Private Organizations and Individuals

Comments on the Draft Environmental Statement were requested from the following agencies:

U.S. Department of the Army
U.S. Department of Commerce
U.S. Department of Health, Education, and Welfare
U.S. Department of the Interior
U.S. Department of Transportation
Environmental Protection Agency
Federal Power Commission
Governor of the Commonwealth of Virginia
Virginia Division of Planning and Community Affairs
Central Virginia Planning District Commission

SUMMARY OF COMMENTS AND RESPONSES

U.S. Department of the Army

(1) Comment: "It should be more clearly stated that the entire Buffalo River watershed is not included in this project, but only that portion above the Southern Railway System tracks. The complete watershed includes all land draining into the Buffalo River, which terminates at its junction with the Piney River where the Tye River is formed (7.6 miles upstream of the James)."

Response: The watershed area has been more adequately described on pages 1 and 2.

(2) Comment: "It is assumed that population datum is approximated from 1970 census figures, but the source and year should be indicated."

Response: Population data and projections were obtained from data prepared by the University of Virginia Bureau of Population and Economic Research. Basic information is from the 1960 and 1970 census.

(3) Comment: "In referring to faunal populations it would be helpful if subjective adjectives such as moderate, good, and fair were defined."

Response: Adjectives such as good, moderate or fair, and poor have been determined by observations in the field and checked by consulting with district game and fish biologists, and local game law enforcement personnel. Deer and wild turkey population surveys compiled by Virginia Game and Inland Fisheries' field personnel indicate a deer population between one and five per square mile and wild turkey at less than one per square mile. The Fish and Wildlife section of the narrative on pages 16 through 19 has been modified to include additional information on habitat factors which modify fish and wildlife populations.

(4) Comment: "This section should more adequately describe the biota that are dependent on the existing river and tributary conditions during part or all of their life cycles. For example, smallmouth bass are associated with free-flowing streams and rivers. Impoundment will create conditions in which they will cease to exist, and which are favorable to population by large-mouth bass."

Response: Information pertaining to the aquatic ecosystem has been added on pages 16 and 17, and terrestrial ecosystems on pages 17 - 19. Table XI has been added and the Environmental Impact section expanded on pages 33 through 44.

(5) Comment: "It is stated that on the basis of stream gauge records '..... 145 floods have occurred on Buffalo River since the gauging station was established in 1940.' It should be added that the station is located at Piedmont, Virginia, which is eight miles downstream of Southern Railway System tracks (the downstream limit of project area). Water flowing at the gauging station is from the entire Buffalo River watershed (except for Taylors Creek and two intermittent creeks) of which the project represents only a portion. It is possible, depending on distribution of rainfall, that flooding can be less, the same, or as great within the project limits as at Piedmont. Whatever assumptions are made should also be stated."

Response: The reference to 145 floods since 1940 was deleted and a discussion of the gage records added on page 24. The gage records substantiate that approximately two to three floods per year occur. Gage records for the original and relocated gages were reviewed as a result of this comment and the U. S. Department of the Interior comment No. 6 as the reference to 145 floods was found to be in error.

(6) Comment: "'Planned conservation land treatment measures will reduce erosion by approximately 14 percent, to approximately 6 tons per acre.' This would be more meaningful if a time frame were given."

Response: Oversight corrected. See page 34.

(7) Comment: "'The frequency of beginning damage to flood plain improvements will be reduced from about the 2-year frequency to once in 5 years.' It would be of benefit if 'beginning damage' was defined."

Response: A storm occurring once in 2 years under present conditions, will produce a flood stage equivalent to the point of beginning damage for improvements located within the flood plain. After the project is installed, a storm which would occur on the average of once every 5 years would be needed to produce the same stage. Beginning damage is when the water begins to damage agricultural land and improvements along the stream such as highways, bridges, fences and other improvements. See page 35.

(8) Comment: "The expected damages are stated, but this section must include a discussion on the effects of these damages. For example, the effect of overcrowding pressures on zoological elements in areas to remain unflooded when they are encroached upon by those displaced from flooded areas."

Response: Terrestrial forms of wildlife will lose use of less than 1 percent of the watershed, thus no crowding is anticipated. However, 413 acres of aquatic habitat (a 2000 percent increase) will become available to fish, amphibians, turtles, waterfowl, shorebirds, and other forms that require water areas. Detailed information for each structure site has been added. See pages 43 and 44.

(9) Comment: "Appendix C - Project Map - The map should be retitled to indicate that this is a portion, not the entirety, of the Buffalo River watershed. (See first comment.)"

Response: This comment is similar in part to Comment No. 1 by the U.S. Department of the Army, Corps of Engineers, set forth and responded to on page 61. Please refer to that discussion for a full response. The map indicates the project area with the cutoff at the Southern Railway not the entire Buffalo River at the confluence of the Tye River.

U.S. Department of Commerce

(1) Comment: "Section 1, Description: Information on the rate of sedimentation and the expected life of the reservoirs should be presented in this section."

Response: The statement has been modified on page 30, to show that the structures' design is based upon an expected life of 100 years. The sedimentation rate considers the average annual rate expected over the design life.

(2) Comment: "A species list of biota in the area should be provided in the subsection on Fish and Wildlife and Recreation Resources."

Response: A species list of biota has been added. See Tables I, IV, V and VI.

(3) Comment: "The amount of soil erosion that is expected to be caused by construction of the project should be discussed in the subsection on Structural Measures."

Response: The amounts of sediment yield resulting from construction activities at sites has been added to the section on structural measures. See page 31.

(4) Comment: "Section 2, Environmental Impact: In section 6, on page 18, it is stated that 'Six Public Law 566 watershed projects, comprising about 670 square miles total drainage area, have been approved for installation in the James River Basin.' The potential cumulative or collective impact of these six projects and the Buffalo River project on the salinity of the James River estuary should be thoroughly discussed here and, if applicable, in the section on adverse effects."

Response: The statement has been expanded on page 36 to include information on effects to flow on the lower reaches of the James River by structures in the six projects.

Since water quality is expected to be unaffected (See Virginia State Water Control Board Report in Appendix C) the only impact on the salinity of estuary waters would be reduction or increase in the flows that normally occur through the estuary. The added information on page 36 indicates negligible effect to flows in the James River estuary.

(5) Comment: "The possibility and environmental impact of dam breakage due to faulty construction, earthquakes, prolonged stress, etc., should be evaluated and discussed."

Response: A search of literature back to 1802 discloses no recorded earthquakes in Amherst County and no major earthquakes in Virginia since 1897. A major earthquake is defined here as above 9 on the Mercalli scale. This watershed is in Algermissions Seismic Risk Zone 2 which has earthquake magnitudes (Richter)1/ ranging from 4.5 to 6.0. (Magnitude 4.5, breakage of dishes and disturbance of tall buildings; magnitude 6.0, wall, monuments, and chimneys fall and cracks in ground.)

All construction in this watershed will be performed under SCS standard specifications. Quality controls are based upon standards within the industry such as American Society for Testing and Materials, American Water Works Association, American Concrete Institute and Federal Specifications. Soil Conservation Service criteria is based upon the damage to life and property that would result from failure. The structures are designed to draw down to normal pool level in less than 10 days. This would minimize any possibility of prolonged stress.

All construction in this watershed will be carried out under intensive inspection by qualified inspectors. After completion, all structures are inspected annually and after major storms for safety hazards and operation and maintenance needs.

(6) Comment: "Section 5, Alternatives: Flood plain zoning, in combination with single-purpose water supply impoundments, is another alternative that should be considered and discussed."

Response: The Alternatives section has been redrafted and expanded beginning on page 48. This alternative has now been added and is discussed on page 51.

1/ Gutenberg, B., and Richter, C. F., Seismicity of the Earth, GSA Spec. Paper 34, 1941; Also published by the Princeton Univ. Press.

U.S. Department of Health, Education and Welfare

(1) Comment: ". . . this plan will not have a significant adverse impact on the environment. Therefore, we concur with the work plan."

Response: Concurrence is appreciated.

U.S. Department of the Interior

(1) Comment: "We are deeply concerned, however, about the effects of project-induced development on the flood plain. Increased agricultural, residential, and industrial development stemming from this project will result in the further destruction of wildlife habitat. In addition the expected increased use of fertilizers and pesticides on the new agricultural lands and the increased surface run-off from the commercial and residential lands will adversely affect the water quality with a corresponding loss of fish habitat."

Response: One of the major concerns of the sponsors in the formulation of this project was to plan for the judicious, timely, and orderly development of all the area resources. This plan will serve as one of the key information tools for local governing bodies to prepare zoning, development and other guidelines for nonagricultural, as well as agricultural lands; and for setting overall resource development standards and environmental considerations.

The following tables have been included to aid in assessing the expected impacts of the proposed project: Table III - Existing Watershed Land Use, 1970; Table VIII - Projected Watershed Land Use, 1980; Table IX - Estimated Sediment Concentrations; and Table X - Wildlife Land Use Change.

As indicated in Tables No. III and VIII, the total cropland and pasture acreage is expected to decrease on both the upland and the flood plain areas during the project installation period. Thus, there will be a decreasing agricultural acreage, but on the other hand an increased use of pesticides and fertilizers per acre. Whether this increase will be more than, equal to, or less than the decreased use due to decreasing acreage depends on management ability, production needs and operating capital.

Basically pesticides and fertilizers develop a bond with the soil, and in the case of fertilizers are absorbed into plants through the root system. The primary means of these elements reaching the stream would be through erosion. U.S. Forest Service Research Note SE-108, February 1969, concludes that the use of herbicides, even on steep mountain land, does not appear to

constitute a pollution hazard as long as erosion is controlled and when care is taken to protect streamside vegetation and the stream itself from direct contamination.

If the project is installed, flooding and scouring of the flood plain will be reduced by approximately 70 percent. Therefore, nutrients applied to the flood plain soils are not lost through erosion to the degree they would be without flood protection.

A more complete discussion of the effects of project-induced development on pollution, land use, and wildlife habitat have been included on pages 33 through 44.

(2) Comment: "Further, we are also concerned with the increased potential for flood damage when project-induced development takes place in the flood plain below these structures. As upstream development takes place flood flows can increase in frequency and intensity to the point where the design limitations of the structures are exceeded. This can then lead to increased downstream flood damage to the project-induced developments and thereby generating a need for flood control investments. In light of the foregoing, we recommend that local interests be required to undertake a program which would foster sound flood plain management in the Buffalo River Watershed."

Response: Development in the flood plain will be subject to appropriate zoning ordinances of Amherst County and the town of Amherst. These ordinances are currently being revised to include flood plain management to limit development in areas subject to flooding. Expected damages to project induced development are counted as a project cost in computing benefits attributable to the project.

(3) Comment: "For project compliance with the Federal Reservoir Salvage Act (P.L. 86-523), we request that the Director, Northeast Region, National Park Service, 143 South Third Street, Philadelphia, Pennsylvania 19106 be kept informed of the progress of this proposal so that any necessary archeological work appropriate to the post-authorization phase can be programmed for completion prior to the start of project construction."

Response: We concur. See page 19 for actions to be taken.

(4) Comment: "Environmental Setting - Paragraph 3 on page 4 would be improved if it was expanded to provide information on the more recent storms of June and October 1972."

Response: We concur. This additional information has been added on page 13.

(5) Comment: "Fish and Wildlife and Recreation Resources - Page 7, paragraph 3. Add the following to the last sentence of this paragraph --. . . since stream modification following Hurricane Camille has destroyed most of the trout habitat."

Response: A considerable amount of trout habitat was damaged as a direct result of Hurricane Camille. Hurricane Camille dumped a record 31 inches of rainfall in 5 hours along the eastern slopes of the Blue Ridge, including the headwaters of Buffalo River. This triggered avalanche type slides moving huge volumes of mud, boulders, trees, bridges, buildings, and anything else in its path, completely filling and blocking many water courses. This caused river flows to meander across lands in all directions. Technical and financial assistance was given through the Soil Conservation Service in cooperation with other agencies as authorized by Congress. The major objective was to protect lives and property endangered from further floodwater, erosion, or sediment discharge as a direct result of channel impairment. This was carried out by removal of debris, restoration of the channels to a capacity similar to that before the flood, and seeding all disturbed or bare areas.

(6) Comment: "Water and Related Land Resource Problems - Page 8, paragraph 2. We believe the SCS definition of a 'flood' should be included here as USGS records do not verify 145 floods on the Buffalo River since 1940."

Response: The U.S. Army Corps of Engineers raised essentially the same question in their comment 5, page 62. Please refer to modification made on page 24 of the Statement and the discussion on page 62 for response.

(7) Comment: "Planned Project - Page 11. This section should be expanded to indicate what measures are planned as part of the land treatment measures. More information on the wildlife habitat management plan should be given."

Response: This section has been expanded as suggested on page 29.

(8) Comment: "Structural Measures - This section should also be expanded to give specific information and operating program for each dam. No mention is made of the installation of fish weirs above the impoundments to prevent the upstream movement of centrarchid fishes into trout waters. This should be included here if it is part of the project plan."

Response: This section has been expanded to include this information on page 31. It is part of the project plan to install fish barriers constructed with rock filled gabions above reservoirs number 1B and 2, since they are below trout waters. The U.S. Fish and Wildlife Service in concurrence with the Virginia Commission of Game and Inland Fisheries have not requested barriers above reservoirs 3 and 4 since they are not located below trout waters. An operation and maintenance agreement is included under Planned Project section on page 32.

(9) Comment: "Page 12, paragraph 3. State the number and species of fish to be stocked and what plans have been incorporated for their management. Add to sentence 2 the words, 'for a set fee.'"

Response: This information has been included on page 30 and "for a set fee" added.

(10) Comment: "Page 13, paragraph 4. We believe that the contention in sentence 4 that intrusion into the flood plain will result in an improved environment needs some added support. While improvements may be beneficial to agricultural interests, these same beneficial effects do not necessarily extend to wildlife resources and some qualification appears warranted."

Response: The related part of the Environmental Impact section has been revised for clarification. Table VIII has been added on page 33 to provide a summary reference on the projected land use changes by 1980, both with and without the proposed project. This can be compared to Table III added in the Economic Data section on the present (1970) land use. This should help clarify the degree of intrusion as well as departures of different uses on the flood plain.

In brief, no farm buildings are expected to be moved to the flood plain. Improved use and management of this land will allow farm operators to use less acres for cultivated crops to supply their needs; while at the same time returning the more highly erodible upland to grass or other erosion retarding cover. Development of farm operation and land use plans as a part of this project will afford landowners and operators the opportunity to more fully take into account wildlife resources and other esthetic and environmental values considered important in overall area planning. Crop residues and shattered grain from harvesting operations will provide food and cover for wildlife in the area during the fall and winter months. Additional information is included on pages 43 and 44.

(11) Comment: "Cultural Resources - An interdisciplinary investigation of the affected area should be undertaken by professional archeologist and others competent to locate and evaluate cultural resources. The results of the investigation should provide information for discussion in all relevant portions of the environmental statement. Particular attention should be paid to resources discovered during the survey that meet the criteria for nomination to the National Register. All efforts that will be made to eliminate or mitigate adverse effects should be described.

"We suggest also that the environmental statement discuss the applicability of the Reservoir Salvage Act of 1960 (80 Stat. 220) to this project."

Response: The final statement contains this information on page 19 under Archeological and Historical Values.

(12) Comment: "Environmental Impact - This section is inadequate and should be expanded. It should include but not be limited to discussions of the following:"

Comment: "a. Construction effects on water quality, fish habitat and wildlife populations."

Response: The final statement contains additional information. See pages 35 through 41.

Comment: "b. Loss of wildlife habitat due to emplacement of dams."

Response: The final statement contains this information on pages 43 and 44.

Comment: "c. Loss of wildlife habitat due to project development."

Response: The final statement contains additional information on pages 43 and 44.

Comment: "d. Invasion of centrarchid fishes into upstream trout waters."

Response: The statement has been modified to make it clear that fish weirs will be installed to prevent the migration of centrarchids above sites 1B and 2. Centrarchid fishes have existed in the Buffalo River since the first records have been kept. They have in the past been restricted in range to the slower, warmer, downstream portions of the river by their natural habitat requirements, just as the trout have been primarily restricted to the faster, colder flows of the headwaters. Centrarchids occur naturally in the Buffalo River upstream from reservoirs sites 3 and 4, thus fish barriers on these two sites would be purposeless. Sites 1B and 2 are below existing trout waters however, thus fish barriers are planned on those sites.

Comment: "e. The replacement of a stream fishery with a warmwater lake type fishery."

Response: Discussion of this topic has been added on pages 44 and 45.

Comment: "f. Increased sedimentation and run-off due to project-induced development."

Response: There would be temporary increase in sediment production during construction. The increased runoff from the developed area will not be great enough to cause any flooding problem because the area to be developed is not large. See pages 39 and 40.

Comment: "g. The potential for increased flood damage due to storms of greater than 100-year frequency because of project-induced development in flood prone areas."

Response: A storm approaching the magnitude of Hurricane Camille would be expected to produce 1.0 to 1.5 million dollars damage without the proposed project. With the project installed, damages from a storm of this magnitude would be expected to be $500,000 depending on the season of the year and its effect on unharvested crops.

One purpose of the maps and other data developed as a part of the work plan is to provide local governing bodies a tool for guiding the development of both the upland and flood plain areas with due consideration to all interests. One of their major concerns is to minimize flood damages by zoning the use of the somewhat vulnerable areas for parking lots and similar uses that can be relatively easily evacuated, if necessary.

(13) Comment: "The statement that project measures will improve wildlife food and habitat is unsubstantiated. Data on the wildlife habitat improvement measures should be included."

Response: Information on project measures which will improve wildlife food and habitat has been added on pages 27 to 29, and 37 through 39.

(14) Comment: "Page 14, paragraph 2. It is stated that the sediment load downstream will be reduced by 22,000 tons annually. However, no data are given of the expected increases in sedimentation due to construction, increased cultivation, and residential and industrial development. It has already been pointed out in the statement that erosion rates on cropland are 13 tons per acre per year greater than the watershed average. Thus, the erosion due to increased cultivation in the flood plain below the impoundment structures will contribute substantially to the sediment load in the James River Basin. This information should be included."

Response: The U.S. Department of Commerce raised this same point under comment 3 (page 64). No increased land will be cultivated but instead crops will be shifted from the steeper more erodible

uplands to the flatter less erosive flood plain land which will decrease the sediment produced not increase it. Local and state sediment control ordinances will minimize sediment damages from any future residential and industrial development. (See Erosion and Sediment Control Law, Appendix C).

(15) Comment: "Page 14, paragraph 5. This paragraph notes the planned wildlife habitat improvement but fails to consider the expected habitat loss due to project development."

Response: See response to USDI comment (12c) page 70.

(16) Comment: "It is stated here that 5 miles of stream fish habitat will be inundated by the four lakes. No mention is made of the changes in fish species composition that will occur as a result or of the upstream invasion of centrarchid fishes into the trout waters above the reservoirs."

Response: See response to USDI comments 12d and 12e on page 70.

(17) Comment: "Page 15, paragraph 2. This paragraph should mention that the flood hazard from unusual and unexpected floods might actually increase because of project development in the flood plain. The project provides for the 100-year flood but fails to consider the impact of floods in excess of this. Hurricane Camille in 1969 and Hurricane Agnes in 1972 illustrate this point."

Response: Damages from storms in excess of the 100-year recurrence interval are a consideration of all planning agencies. The one-time damage from Hurricane Camille in 1969 was quite out of the ordinary - approximately $1.0 to $1.5 million in Buffalo River. See Department of the Interior comment 12g, page 71 and Environmental Protection Agency comment 7, page 80.

The flood detention capacity of each reservoir structure is designed to temporarily store and retard the runoff from the 100-year frequency rainfall. Any development anticipated above the structures is taken into account in determining the runoff from the design storm. The emergency spillway system for the reservoirs in this watershed are designed to safely pass the runoff from the maximum probable rain as set forth in U.S. Weather Bureau data.1/

Tropical Storm Agnes in June 1972 is estimated as a 10 to 20 year event in the Buffalo River watershed. According to available local reports, a storm of the magnitude of the one that occurred in this area of Buffalo River in October 1972 has a recurrence interval of about 2 to 5 years. Neither of these two later storms would have caused significant damage with the proposed project installed.

1/ U.S. Weather Bureau Technical Paper 40, "Rainfall Frequency Atlas of the United States."

(18) Comment: "Favorable Effects - The effects in this section should be reconsidered in light of our previous comments."

Response: This section has been rewritten. See page 46.

(19) Comment: "Unavoidable Adverse Effects - The impacts in this section should also give recognition to the comments raised in our letter."

Response: This section has been rewritten. See page 47.

(20) Comment: "Alternatives - We believe this section of the statement does not clearly identify and describe the alternative solutions in any detail. The depth of the impact analysis is rather superficial and appears to provide a somewhat biased presentation in favor of the recommended plan. To illustrate our concern on the lack of specificity, we note the first alternative states that land treatment measures will be accelerated and no definitive information as to the scope of the measures planned. Their location and what these measures are should be discussed in some reasonable detail. This same vagueness persists throughout this subsection to the disadvantage of all reviewers. We also believe a more indepth assessment of both beneficial and adverse effects should be set forth for each solution.

"As now written, the impact identification is extremely brief and somewhat biased in favor of the recommended plan. For example, what appears to be the no action alternative discusses the benefits foregone by not building the recommended plan but does not address any of the beneficial effects that could arise by retaining the present environmental setting. Fish, wildlife,esthetics and possibly water quality control may be in an improved position without the recommended plan and, if found to be true, these effects should also be identified. A more detailed discussion of these alternatives is warranted to avoid the bias that now appears to exist in this section.

"Flood plain zoning, flood proofing, evacuation and flood warning systems should also be discussed in this section of the statement. In fact, zoning would appear to be a very desirable increment of the recommended plan since it would aid in reducing future flood damage and flood control investments which could be required because of project induced developments."

Response: The Alternatives section has been rewritten and expanded to give a more in-depth assessment of both beneficial and adverse effects. See pages 48 through 55.

(21) Comment: "Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity - This section should be revised to compare the relative values of the short-term use (with the project installed) with the long-term productivity of natural ecosystems without the project."

Response: This section has been rewritten. See pages 56, 57, and 58.

(22) Comment: "Coordination - The statement declares that no known historic or archeological sites will be affected by the project and that the Virginia State Historic Preservation Liaison Officer and State Archeologist were consulted and will be kept informed if any such values are discovered during construction. We applaud this concern for cultural resources, but we must point out that this does not constitute evidence of interdisciplinary investigation of this integral portion of the environment, nor does it evidence compliance with the requirement of the National Historic Preservation Act of 1960 (80 Stat. 915) or Executive Order 11593 (May 13, 1971). While no known sites may exist in the area, nonetheless cultural resources may in fact exist, and project impacts upon them will remain unknown without proper investigation.

"As early as possible in the planning process it should be determined whether any properties listed or eligible for listing in the National Register of Historic Places (published annually and updated monthly in the 'Federal Register') will be affected by the project. If such effects will occur, the statement should indicate evidence of compliance with Section 106 of the National Historic Preservation Act according to the procedures published in the 'Federal Register' of February 28, 1973."

Response: Refer to comment (11) pages 69 and 70.

U.S. Department of Transportation

(1) Comment: "We have no comments to offer nor do we have any objection to the project."

Response: Concurrence appreciated.

Environmental Protection Agency

(1) Comment: "Cover conditions are described as 'fair to good' and areas in need of special attention as 'small and scattered.' Why then is this particular watershed so much in need of a program for abating its sediment discharge?"

(2) Comment: "If, on the contrary, this basin is not worse than other parts of the James Basin, then a comparable reduction of sedimentation could presumably be produced by comparable measures taken elsewhere in the basin. (These should be mentioned as being among the alternatives to the proposed project.) In this case, it would be most appropriate to describe the overall basinwide erosion and sedimentation program and measures which will be or should be taken to cope with it systematically."

Response: These comments will be answered together.

Land treatment, flood prevention by structural measures, reduction of erosion and increased infiltration rates are primary purposes of the project. It is not mandatory that the primary objectives provide the major portion of the benefits, resulting from the project.

The James River Basin is located in four physiographic provinces. Buffalo River is in the Upper Piedmont and Blue Ridge physiographic province where steeper slopes and more erosive soils are present. It is more similar to other watersheds in this specific area, upper Piedmont and not to the James River Basin as a whole. It is true that a comparable reduction of sedimentation could be produced by comparable measures taken in similar watersheds but these would fail to meet the primary objectives which are to provide the erosion and flood prevention features in the Buffalo River watershed. Therefore, they would not be valid alternatives. The overall basin-wide erosion and sedimentation conditions are described in Chapter IV pages IV 5-10 James River Basin Report, Virginia and West Virginia 1/ as outlined in Appendix C.

Land treatment measures to reduce sedimentation and erosion which have been provided or represent needs have been described in Chapter V, pages 1 - 6, James River Basin Report, Virginia and West Virginia,1/ as outlined in Appendix C.

1/ Unpublished Report.

(3) Comment: "To be more specific, since the Buffalo River project is presumably a small component of a basinwide program to abate erosion and sedimentation, an overview EIS for the program as a whole is needed. The place of the Buffalo River project in the overall program could then be described, including its relative priority and cost-effectiveness. The role of State or Federal erosion control legislation should be mentioned. The need for such regulation governing construction, agricultural practices, and land use should be discussed."

Response: It is anticipated that the U.S. Army Corps of Engineers will have the delegated responsibility for preparation of an Environmental Impact Statement on the James River Basin. The effects of the Buffalo River watershed project will certainly be included in and compared with other basin elements at the time of preparation of the EIS.

The State of Virginia has implemented legislation for the regulation of sedimentation and erosion. A copy of the recently passed law is attached as Appendix C.

(4) Comment: "The effect of past human activities in affecting erosion and sedimentation should be described. How much of the present problem arises from land mis-management, past or present? What is the effect on erosion and on flooding of past SCS stream-channel modifications, such as that which followed Hurricane Camille?"

Response: The county agricultural picture has changed appreciably in Amherst County the last 30 years. In 1939, about 33,200 acres were used as cultivated cropland, while 29,100 was in pasture. In 1969 this amount had decreased to about 14,176 acres of cropland and 15,818 acres of pasture. Table XII shows some of the more radical changes in the county cropping pattern.

TABLE XII

COUNTY AGRICULTURAL LAND USE CHANGE

CROP	1939 1/ Acres	1969 2/ Acres
Total Cropland	33,200	14,176
Corn	11,200	1,642
Wheat	4,500	241
Other small grains	1,300	118
Tobacco	1,600	208
Hay	9,100	7,748
Other Cropland 3/	5,500	4,219
Total Pasture	29,100	15,818

1/ USDA Statistical Reporting Service, Amherst Co., July 1967.
2/ U.S. Census of Agriculture, Amherst County, Va., 1969.
3/ Includes orchards, miscellaneous crops, idle cropland, soil improvement crops, fallow, etc.

This table is indicative of the past human activities in Amherst County affecting erosion and sedimentation. Activities in the watershed area were assumed to follow the same general pattern. The higher amounts of row crops in the past contributed to much of the flooding problems that now exist. In the past 30 years, much has been done to lessen erosion, but deposits of sediment on the flood plain and in the channel are still persisting and contributing to the flooding problem. The land treatment measures proposed in this work plan are designed to put the proper crops on the proper land.

The objective of the work done on Buffalo River channels following Hurricane Camille was to clean out debris deposited during the flood. The restoration of streams to near their pre-storm alignment, cross section and capacity and the revegetation of streambanks reduced the out-of-banks flow or flooding of adjacent flood plain. In addition, the work eliminated the need for the stream to cut a new channel at a different location. This resulted in less erosion and scour, thus less sedimentation downstream. (Also refer to pages 10 and 49 for additional details on Hurricane Camille.)

(5) Comment: "Flooding and sediment deposition play a fundamental role in maintaining the structure of a flood plain. Flood plain soils arise from such deposition and often depend on it for their fertility. Stream meanders are the result of the hydraulics of the flood flows, and flood plain vegetation is usually characteristic and dependent on intermittent flooding.

"What will be the long term effect of interfering with this natural process? Why is it now necessary to interfere with it after the passage of millenia during which the stream, including its integral flood plain, took care of itself?"

Response: Population growth pressures and the changes in man's social needs and demands, be they real, imagined, perceived, or timely, constantly cause reevaluation of his relationship to his environment.

Within the watershed area, the people have come to the conclusion that uncontrolled flooding is no longer economically acceptable. This means that the "wild" or "natural processes" and man's activities must be compromised to reach a new harmonious plane. This normally results in an intensity of management differing from that which has existed in modern man's visible past.

Wild, "natural" flooding has come to the point in evolution where attempts are being made by man to constrain and modify it where possible to be more compatible with current needs. As a result, the flood plain vegetation which is ecologically adapted to or dependent upon frequent flooding will change gradually in the areas not developed by man for agriculture or urban use. Where agricultural management intensity increases, the vegetation change can be very abrupt as it is changed from natural to introduced vegetation which has a greater productive response capacity. This is not to say that the natural processes have been "interfered" with, at least in a detrimental or totally "unnatural" way. As man is part of the total ecosystem, it is hard to say whether this is or is not a normal evolutionary change.

Interfering with a natural process is not the objective. The project is an attempt to deal with the recurring flooding situation now existing, with a minimum of disruption to all processes of environmental development. It is an attempt to bring the "physical processes" and "man-made processes" into a more harmonious relationship. The present situation was brought about by agriculture being forced off the flood prone flood plain. More upland acres were needed to get the required crop production as was being grown on the more productive flood plain acres.

Intense cultivation of uplands and lack of soil and water conservation practices have in the past, resulted in excessive erosion of soils. The accelerated rates of erosion produces more frequent flooding and an increased deposition of infertile sediments on the flood plain. Data in the work plan shows that 269 out of 600 flood plain acres of crop and pastureland sustained modern sediment damage as a result of accelerated erosion.

An objective of the project is to reduce inundation and concurrent infertile sediment deposition of the flood plain. This is accomplished by, first, proper treatment and management of upland soils, second, encouraging use of land according to its capabilities and third, use of structural devices to regulate excessive runoff. The goal of soil and water conservation is to, as nearly as possible, reduce rate of runoff, sedimentation and erosion to those of natural conditions.

(6) Comment: "The monetary damages assigned to downstream sedimentation are not realistically calculated. Despite disclaimers, it is implicitly assumed that all sediment discharged from the Basin must be dredged from the navigational channel. We estimate that if this were true and if the Buffalo River Basin were typical of the watershed of the James River above Richmond, dredging out the sediment contributed by just this portion of the total James Basin watershed would cost some $5.6 million annually (at $1.46/cubic yard; see Work Plan, p. 35). This is several times more than is spent. On the otherhand, no monetary value was assigned to the effects of sedimentation and the dredging which it necessitates on the aquatic ecosystem. The two departures are in opposite directions, but we feel no assurance that they are of comparable magnitude. A better estimate of damages is needed. We know SCS is aware that it is important to estimate the benefits and costs of different project functions accurately. Only thus can one determine the best alternative management plan for environmental resources. This applies equally to economic and to environmental contributions to the total project impact."

Response: The comment that "Despite disclaimers it is implicitly assumed that all sediment discharged from the basin must be dredged from the navigational channel" is not correct. Succeeding portions of this comment which refer to $5.6 million annual dredging estimates are therefore invalid. The section on Environmental Impacts has been expanded to include discussion of the values of sedimentation effects on the aquatic ecosystems. (Pages 35 and 36).

The Soil Conservation Service agrees that it is important to estimate the benefits and costs of different project functions accurately. Where cost data are available to the Soil Conservation Service these are used to the degree of accuracy commensurate with the accuracy of the data. The Soil Conservation Service agrees that better estimates (both physical and monetary) of sedimentation damages to various elements of the ecosystem are needed and commends and supports efforts of agencies with responsibilities for data collection and research in these ecological areas.

(7) Comment: "One important effect is to stimulate the urbanization of land which is now agricultural and is kept from intensive use by frequent flooding. Development of the floodplains needs to be subject to appropriate zoning ordinances,otherwise portions which are still subject to occasional flooding may be occupied. (Damage to such 'project induced development' should be counted as a project cost.) We recommend that local participation in the Federal Flood Insurance Program or some other form of commitment to proper regulation of floodplain land-use should be required as a prior condition for Federal participation in the project."

Response: Development in the flood plain will be subject to appropriate zoning ordinances of Amherst County and the town of Amherst. Expected damages to project induced development are counted as a project cost in computing benefits attributable to the project. A key concern of the local sponsors of this project was to develop guidelines for the timely, judicious and orderly development and use of all the area's land, water and other resources. This plan, and data developed during its preparation, and inventories and evaluations during its installation will serve as basic tools for local planners and governing bodies to prepare zoning regulations and other guidelines for overall resource development standards and environmental considerations on both flood plain and upland areas. The maps and other data prepared as a part of this project work plan provide local interests with guidelines for flood plain zoning and management plans which they have under development to help prevent future increased flood damages.

(8) Comment: "The urbanization of the flood plains, the local stimulation of increased economic activity and the more intensive agricultural cultivation will all have effects on water run-off, erosion, sedimentation, and water quality. These effects must be identified to appreciate the net overall effects of the project."

Response: Production from two acres of well managed flood plain is at least equal to that from three acres of upland in this area. By increasing cropland in the protected flood plain, coupled with a high level of management, farm operators will use less acres for cultivated crops to supply their needs; thereby, returning more of the highly erodible upland to grass or other erosion retarding cover. Development of farm operation and land use plans as a part of this project will provide landowners and operators with information to more fully take into account the overall resources, esthetic and environmental values important to area development.

Project measures influence on erosion, sedimentation and water quality are somewhat interrelated. The slope of the flood plain cropland in this watershed ranges from 1 to 5 percent and produces an average of 3.5 tons of sediment per acre per year. Upland slopes range from 10 to 20 percent and produce an average of 28 tons of sediment per acre per year from cropland; while upland grassland averages 2 to 3 tons per acre. Increased use of fertilizer per acre on flood plain cropland results in more efficient use of the material by the crops, thereby increasing production per acre. With fewer acres of cropland required to provide the operators' needs an increase in the total amount of fertilizer is not expected. In regard to pesticides - these are generally confined to herbicides used on cultivated crops. With a decrease in acreage possible where cultivated crops can be moved to the flood plain, fewer acres will require treatment. This would decrease the requirements for these items, and if anything, should have a beneficial effect on water quality. Also, technical advice to all landowners and operators will be continually updated for the latest recommendations for the use of these and other compounds, along with other management practices which will improve the general environment and operating efficiencies.

(9) Comment: "Benefits from changes in land-use may not be 'National Economic Development Benefits' in the sense used in the Proposed Principles and Standards of the Federal Water Resources Council. The idea is that increases in land values induced by conversion from agricultural to urban land-use arise from a diversion of development which would have occurred elsewhere in the absence of the project. This represents a gain for the individual municipality but no net gain for the nation. A similar argument presumably applies to conversion of land from one form of agricultural use to another, and a somewhat similar argument would cause one to disallow the 'local secondary benefits'."

Response: Soil Conservation Service policy for evaluation of damages and benefits in this watershed project is based on Senate Document 97 and Supplement 1 of that document. All evaluations were carefully reviewed for conformance to Service policy and guidelines during the technical review procedures of work plan development. It is assumed that values, goods and services in other areas of the nation will respond to their spheres of influence. Benefits to this project represent the influence of the proposed project on these values which will be produced as a part of the nation's goods and services in this area. They include such considerations as reduction of existing damages to properties and the goods and services in the watershed; the net beneficial effect on the use, management and production of these goods and services; and the maintenance of the

nation's resources; with descriptive consideration of the esthetic and environmental values for which monetary evaluation criteria have not been developed. Secondary project benefits are not considered when evaluating the economic justification of the project's benefits and costs.

(10) Comment: "The environmental effects of the proposed Buffalo River project need a great deal of further discussion. We need to be informed concerning the present hydrology, water quality and biology of the affected streams and floodplains. We need to know what changes in these factors would result from project implementation. In particular, what would be the water quality in the new reservoirs and what effects on the aquatic and terrestrial ecologies would be expected to result? What would be the effects downstream of the reservoirs on turbidity, water quality, temperature and stream ecology? In particular, will changes in flow regime or water quality interact with any benthic deposits remaining from the discontinued titanium mining operation at Piney River, or other features of water quality in the Tye? (Relevant material from CB-SRBP Working Document No. 21, FWPCA, January 1968, is appended to these comments for your information.) What will be the effects on environmental variables of the land-use changes intended to be promoted by project implementation? How will recreational use of the reservoirs be promoted, supervised and controlled? What environmental effects will ensue? How will wildlife be managed and protected in areas affected by the project?"

Response: The Statement has been revised to provide further discussion of these questions. See pages 11 and 12. A letter from the State Water Control Board is attached as Appendix C.

Federal Power Commission

No comment received.

Governor of the Commonwealth of Virginia

Comment Summary: Commend the project and request high priority.

Response: Approval appreciated.

Virginia Division of Planning and Community Affairs - State Clearinghouse

Comment: No objections.

Response: Cooperation appreciated.

Central Virginia Planning District Commission

No comment received.

9. List of Appendixes

Appendix A - Comparison of Benefits and Costs for Structural Measures

Appendix B - Letters of Comment Received on the Draft Environmental Statement

Appendix C - Water Quality Data - State Water Control Board
Excerpts of James River Basin Report
Sediment Control Legislation - State of Virginia

Appendix D - Project Map

APPROVED BY _____ DATE DEC 21 1973

Acting Kenneth E. Grant
Administrator

APPENDIX A - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Buffalo River Watershed, Virginia

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 3/	Benefit Cost Ratio 4/
	Damage Reduction	More Intensive Land Use		Municipal Water Supply	Incidental Recreation	Local Secondary	Total		
		Agr.	Urban						
All Structural Measures	58,785	19,250	25,400	71,165	40,170	9,185	223,955	111,967	2.0:1.0
Project Administration	xxx	xxx	xxx	xxx	xxx	xxx	xxx	9,689	xxx
GRAND TOTAL	58,785 2/	19,250	25,400	71,165	40,170	9,185	223,955	121,656	1.8:1.0

1/ Price Base: 1970 Adjusted Normalized Prices

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $12,990 annually.

3/ Cost amortized over 100 years at 5-3/8 percent discount rate applicable when plan was developed.

4/ Based upon 5-3/8 percent discount rate applicable when plan was developed. The benefit-cost ratio is 1.4 to 1.0 based upon 1973 prices and a discount rate of 6-7/8 percent, which became effective October 30, 1973 in accordance with Water Resource Council Principles and Standards.

Date: October 1973

Appendix B

COMMONWEALTH OF VIRGINIA
OFFICE OF THE GOVERNOR

August 3, 1973

sion of State Planning
d Community Affairs
nas A. Christophersen
Director

Administration Section
Office of
Project Coordination
1010 James Madison Building
109 Governor Street
Richmond, Virginia 23219
Telephone (804) 770-4776

MEMORANDUM

TO: Mr. R. Jones
Soil Conservation Service

FROM: A-95 Project Review Officer
Division of State Planning and Community Affairs

SUBJECT: Project Notification and Review
Applicant: Robert E. Lee Soil & Water Conservation District

Project: Draft Environmental Statement Buffalo River Water Shed

State Clearinghouse Control Number: 73 03 0 140
DSPCA Staff Contact: C. R. Burbach

The State Clearinghouse has reviewed the Summary Notification for the above project.

As a result of the review, it has been determined that the proposed project is in accord with State plans, programs and objectives as of this date. You should now complete and file your formal application with the appropriate Federal agency (s). A copy of this form must be attached to your application.

Please notify this State Clearinghouse of the filing date as soon as your application is submitted. If you have any questions, please contact the DSPCA staff member named above.

Comment: No State agency objections to proposed project in Amherst County.

Copy to Regional Clearinghouse

Form SC-A95-2

PDC #11

Please Return this Portion of Form

SCC No. 73 03 0 140

TO: A-95 Information Officer
Division of State Planning and Community Affairs
1010 James Madison Building
Richmond, Virginia 23219

On what date was your application officially submitted to the respective Federal agency? _____

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION III
3535 MARKET STREET
PHILADELPHIA, PENNSYLVANIA 19101

May 3, 1973

OFFICE OF THE
REGIONAL DIRECTOR

MAILING ADDRESS:
P.O. BOX 13716
PHILADELPHIA,
PENNSYLVANIA, 19101

Mr. Kenneth Grant
Administrator
U.S. Department of Agriculture
Soil Conservation Service
Washington, D.C. 20250

Dear Mr. Grant:

I have reviewed the Watershed Work Plan for the Buffalo River, Watershed, Virginia. In my opinion, this plan will not have a significant adverse impact on the environment. Therefore, we concur with the work plan.

Thank you for the opportunity to review and comment on this plan.

Sincerely yours,

John E. McKenna
Regional Environmental
Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

May 9, 1973

Mr. Kenneth E. Grant
Administrator
Soil Conservation Service
U.S. Department of Agriculture
Washington, D.C. 20250

Dear Mr. Grant:

We have completed our review of the draft EIS for the Buffalo River Watershed project, Amherst County, Virginia. In general, we feel that this project may have some environmentally beneficial effects, most notably reduction in downstream sedimentation. We would like to see this function related to the overall problem of sediment abatement and erosion control in the James Basin. Other project effects, such as the provision of recreational water bodies cannot yet be adequately evaluated because of the lack of detail in the EIS on water quality and its expected effects on aquatic ecology. Secondary effects of the stimulation of economic growth also need further consideration.

Reduction in flooding, which is a primary project purpose, may be beneficial if steps are taken to secure needed control over land-use in the affected floodplains. Otherwise, unwisely sited development could wipe out the potential project benefits.

Because of our feeling that such land use control can and should be secured, and because many questions concerning the environmental effects of the watershed project have not been answered by the EIS, we have assigned this project to EPA reporting category ER-2. The letters "ER" stand for "environmental reservations", and the numeral "2" indicates that we feel that further information should be provided in the EIS so that the project's environmental impacts can be fully assessed.

OFFICE OF THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

April 25, 1973

Mr. Kenneth E. Grant
Administrator
Soil Conservation Service
U.S. Department of Agriculture
Washington, D. C. 20250

Dear Mr. Grant:

The draft environmental impact statement for the Buffalo River Watershed, Virginia, which accompanied your letter of February 26, 1973, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the draft environmental statement and has the following comments to offer for your consideration.

Section 1, Description: Information on the rate of sedimentation and the expected life of the reservoirs should be presented in this section.

A species list of biota in the area should be provided in the subsection on Fish and Wildlife and Recreation Resources.

The amount of soil erosion that is expected to be caused by construction of the project should be discussed in the subsection on Structural Measures.

Section 2, Environmental Impact: In section 6, on page 18, it is stated that "Six Public Law 566 watershed projects, comprising about 670 square miles total drainage area, have been approved for installation in the James River Basin." The potential cumulative or collective impact of these six projects and the Buffalo River project on the salinity of the James River estuary should be thoroughly discussed here and, if applicable, in the section on adverse effects.

The possibili:y and environmental impact of dam breakage due to faulty construction, earthquakes, prolonged stress, etc., should be evaluated and discussed.

Section 5, Alternatives: Flood plain zoning, in combination with single-prupose water supply impoundments, is another alternative that should be considered and discussed.

We hope these comments will be of assistance to you in the preparation of the final statement. We would appreciate receiving a copy of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

cc: CEQ (10)
Mr. Payne
Mr. Ellert
Dr. Aron

COMMONWEALTH OF VIRGINIA
OFFICE OF THE GOVERNOR
RICHMOND 23219

LINWOOD HOLTON
GOVERNOR

March 8, 1973

Mr. Kenneth E. Grant, Administrator
United States Department of Agriculture
Soil Conservation Service
Washington, D. C. 20250

Dear Mr. Grant:

Thank you for sending me the work plan for the Buffalo River Watershed, along with the environmental impact statement required by the National Environmental Policy Act of 1969.

The Virginia Soil and Water Conservation Commission has thoroughly reviewed all the factors involved in this project and recommends its approval. I, therefore, commend the project for your approval and request that high priority be given to it because of the recent disastrous floods in the area.

Best wishes.

Cordially,

Linwood Holton

Deputy Administrator for Watersheds

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS: (GWS/83)
U.S. COAST GUARD
400 SEVENTH STREET SW.
WASHINGTON, D.C. 20590
PHONE: 426-2262

9 MAR 1973

orable Kenneth E. Grant
dministrator, Soil Conservation
Service
epartment of Agriculture
/ashington, D. C. 20250

r Mr. Grant:

s is in response to your letter of 27 February 1973 addressed to Admiral eder transmitting the draft environmental impact statement for the Buffalo ek Watershed Project, Amherst County, Virginia for review and comment the Department of Transportation.

e concerned operating administrations within the Department have iewed the impact statement. We have no comments to offer nor do we e any objection to the project.

e opportunity for the Department of Transportation to review the draft tement for the Buffalo Creek Watershed is appreciated.

Sincerely,

W. M. BENKERT
Rear Admiral, U. S. Coast Guard
Chief, Office of Marine Environment
and Systems

Please feel free to call on this office for any necessary clarification of these comments.

Sincerely yours,

Robert J. Blanco

Robert J. Blanco, P.E.
Chief
Environmental Impact Branch

Enclosure

cc: CEQ
Mr. Ralph O. Tucker
Mr. Robert Cermak

DETAILED COMMENTS ON THE DRAFT EIS, BUFFALO RIVER PROJECT, AMHERST COUNTY, VIRGINIA

From an environmental viewpoint the most beneficial effect of this project is probably the reduction in downstream sedimentation. This function also provides a substantial fraction of the monetary benefits claimed. However, a number of questions remain to be answered in this context:

1. Cover conditions are described as "fair to good" and areas in need of special attention as "small and scattered". Why then is this particular watershed so much in need of a program for abating its sediment discharge?

2. If, on the contrary, this basin is not worse than other parts of the James Basin, then a comparable reduction of sedimentation could presumably be produced by comparable measures taken elsewhere in the basin. (These should be mentioned as being among the alternatives to the proposed project.) In this case, it would be most appropriate to describe the overall basinwide erosion and sedimentation program and measures which will be or should be taken to cope with it systematically.

3. To be more specific, since the Buffalo River project is presumably a small component of a basinwide program to abate erosion and sedimentation, an overview EIS for the program as a whole is needed. The place of the Buffalo River project in the overall program could then be described, including its relative priority and cost-effectiveness. The role of State or Federal erosion control legislation should be mentioned. The need for such regulation governing construction, agricultural practices, and land use should be discussed.

4. The effect of past human activities in affecting erosion and sedimentation should be described. How much of the present problem arises from land mis-management, past or present? What is the effect on erosion and on flooding of past SCS stream-channel modifications, such as that which followed Hurricane Camille?

5. Flooding and sediment deposition play a fundamental role in maintaining the structure of a floodplain. Floodplain soils arise from such deposition and often depend on it for their fertility. Stream meanders are the result of the hydraulics of the flood flows, and flood plain vegetation is usually characteristic and dependent on intermittent flooding.

What will be the long term effect of interfering with this natural process? Why is it now necessary to interfere with it after the passage of millenia during which the stream, including its integral floodplain, took care of itself?

6. The monetary damages assigned to downstream sedimentation are not realistically calculated. Despite disclaimers, it is implicitly assumed that all sediment discharged from the Basin must be dredged from the navigational channel. We estimate that if this were true and if the Buffalo River Basin were typical of the watershed of the James River above Richmond, dredging out the sediment contributed by just this portion of the total James Basin watershed would cost some $5.6 million annually (at $1.46/cubic yard; see Work Plan, p. 35). This is several times more than is spent. On the otherhand, no monetary value was assigned to the effects of sedimentation and the dredging which it necessitates on the aquatic ecosystem. The two departures are in opposite directions, but we feel no assurance that they are of comparable magnitude. A better estimate of damages is needed. We know SCS is aware that it is important to estimate the benefits and costs of different project functions accurately. Only thus can one determine the best alternative management plan for environmental resources. This applies equally to economic and to environmental contributions to the total project impact.

The proposed project will have a number of effects on land use, some intended, others perhaps not.

1. One important effect is to stimulate the urbanization of land which is now agricultural and is kept from intensive use by frequent flooding. Development of the floodplains needs to be subject to appropriate zoning ordinances, otherwise portions which are still subject to occasional flooding may be occupied. (Damage to such "project induced development" should be counted as a project cost.) We recommend that local participation in the Federal Flood Insurance Program or some other form of commitment to proper regulation of floodplain land-use should be required as a prior condition for Federal participation in the project.

2. The urbanization of the flood plains, the local stimulation of increased economic activity and the more intensive agricultural cultivation will all have effects on water run-off, erosion, sedimentation, and water quality. These effects must be identified to appreciate the net overall effects of the project.

3. Benefits from changes in land-use may not be "National Economic Development Benefits" in the sense used in the Proposed Principles and Standards of the Federal Water Resources Council. The idea is that increases in land values induced by conversion from agricultural to urban land-use arise from a diversion of development which would have occurred elsewhere in the absence of the project. This represents a gain for the individual municipality but no net gain for the nation. A similar argument presumably applies to conversion of land from one form of agricultural use to another, and a somewhat similar argument would cause one to disallow the "local secondary benefits".

The environmental effects of the proposed Buffalo River project need a great deal of further discussion. We need to be informed concerning the present hydrology, water quality and biology of the affected streams and floodplains. We need to know what changes in these factors would result from project implementation. In particular, what would be the water quality in the new reservoirs and what effects on the aquatic and terrestrial ecologies would be expected to result? What would be the effects downstream of the reservoirs on turbidity, water quality, temperature and stream ecology? In particular, will changes in flow regime or water quality interact with any benthic deposits remaining from the discontinued titanium mining operation at Piney River, or other features of water quality in the Tye? (Relevant material from CB-SRBP Working Document No. 21, FWPCA, January 1968, is appended to these comments for your information.) What will be the effects on environmental variables of the land-use changes intended to be promoted by project implementation? How will recreational use of the reservoirs be promoted, supervised and controlled? What environmental effects will ensue? How will wildlife be managed and protected in areas affected by the project?

3. Tye River and Tributaries

Station #1 - Tye River at the Virginia County Road 665 Bridge near Tye River, Virginia.

This station was located upstream from the confluence with the Piney River. The water was clear and a large minnow population was observed. Darters, a member of the perch family, were sampled in the qualitative and quantitative sample. These fish are generally associated with high quality water.

High water quality was indicated both by the number of kinds (genera) and the high percentage of clean-water bottom organisms which were found at this station. The 15 kinds found included such clean-water forms as mayflies (5 genera), caddisflies (2 genera), stoneflies, a gill-breathing snail, and hellgrammites. A total of 121 bottom organisms was taken in the square foot sample which included 72 caddisflies, 35 mayflies, and one hellgrammite.

Station #2 - Piney River approximately 80 yards upstream from Virginia Route 151 Bridge at Piney River, Virginia.

The water at this station was extremely clear and minnows were abundant throughout the area. A hognose sucker about 12 inches long was observed and captured while sampling. The riffle area was extremely large and moss was abundant on the rocks. A total of nine different kinds (genera) of bottom organisms was found which included such clean-water forms as mayflies (4 genera) and caddisflies (2 genera). Two intermediate forms and an organic pollution-tolerant form were also sampled. However, the bottom organism populations were low and only four bottom organisms were collected in the square

foot sample. Based on the qualitative sampling, fair populations of mayflies and caddisflies were present. Good water quality was indicated at this station.

Station #3 - Piney River at Virginia County Road 674 downstream from the American Cyanamid Company at Piney River, Virginia.

The water color at this station had changed to a bluish-green, and the underside of the rocks was covered with an orange precipitate about one-fourth inch thick. Bottom organisms could not be found at this location. It appears that this water degradation is the result of the American Cyanamid Company's operation upstream at Piney River, Virginia.

Station #4 - Tye River at U. S. Route 29 Bridge downstream from the confluence with the Piney River.

The water was clear and all of the rocks were covered with an orange precipitate. Bottom organisms could not be found. Degraded biological conditions are the result of polluted water from the Piney River.

Station #5 - Tye River at Virginia County Road 739 downstream from Tye River, Virginia.

The water was clear and all of the rocks were covered with an orange precipitate. Bottom organisms were absent. Poor water quality is attributed to the Piney River.

Station #6 - Tye River at the Virginia County Road 654 upstream from the Buffalo River confluence.

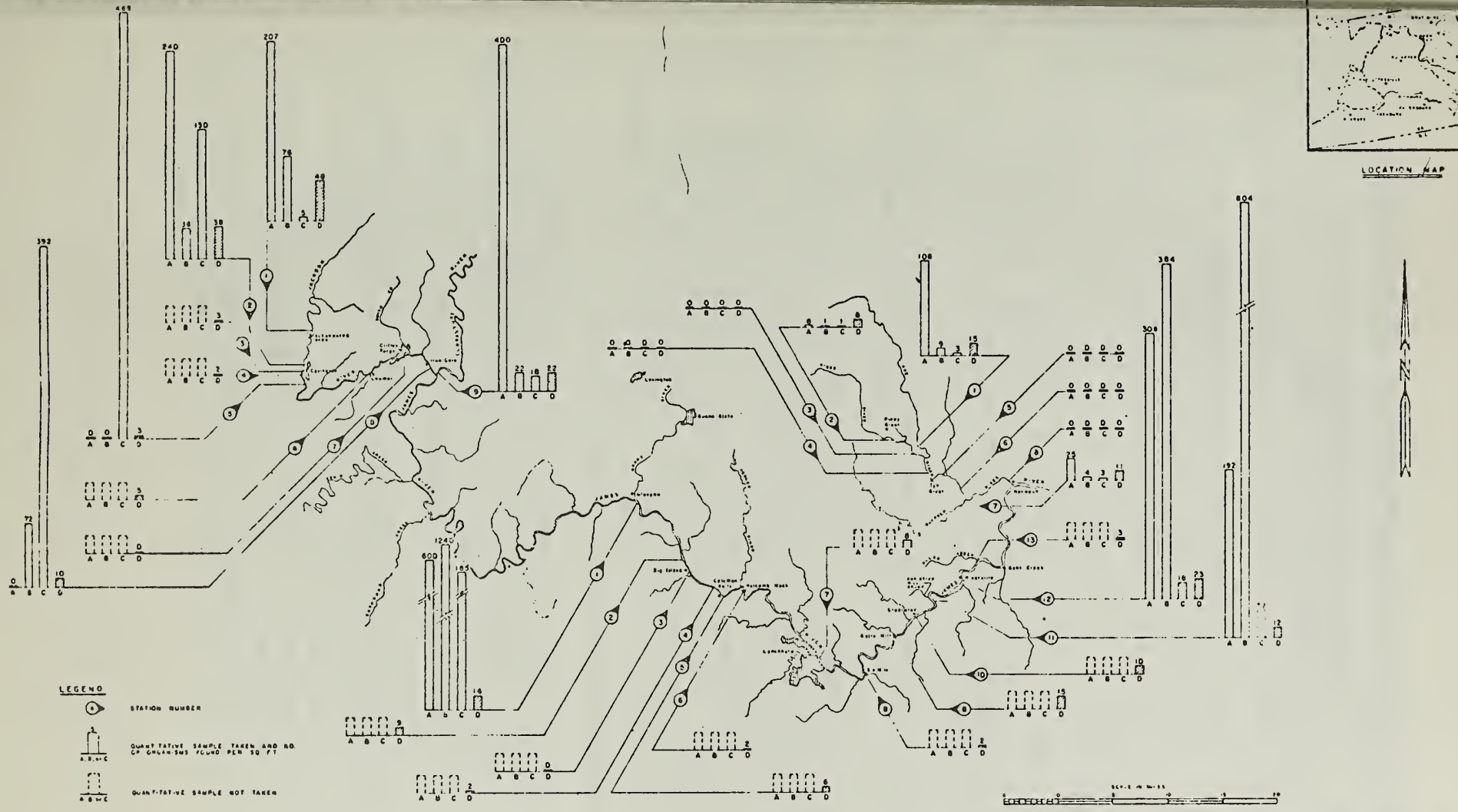
The water was clear and rocks were covered with an orange precipitate. Bottom organisms were still absent. Degraded water quality was still indicated.

Station #7 - Buffalo River at the Virginia County Road 657 Bridge upstream from its confluence with the Tye River.

The water was slightly cloudy from recent rains in the watershed; however, excellent water quality was indicated by the 11 kinds (genera) of bottom organisms which included such clean-water forms as stoneflies (2 genera), mayflies (3 genera) and caddisflies (2 genera). Only 32 bottom organisms were collected in the square foot sample; however, it included two stoneflies, 16 caddisflies, and seven mayflies. The qualitative sample indicated an excellent stonefly population and good mayfly and caddisfly population. If lower water conditions had prevailed, it is believed the quantitative sample would have been much more productive. High water quality was indicated.

Station #8 - Tye River near the mouth at the Virginia County Road 626 at Norwood, Virginia.

The water remained clear and the orange precipitate still was present on the rocks. Bottom organisms could not be found. Degraded biological conditions which were produced by the water from the Piney River are still evident. Poor water quality was contributed to the James River by the Tye River, and apparently James River water quality is adversely affected. How far downstream this affected the James River is difficult to say since water conditions were too high for biological sampling in the James River. However, the rocks were still covered with the orange precipitate at the first bridge crossing on the James River downstream from the confluence with the Tye River.



JAMES RIVER BASIN
CHESAPEAKE DRAINAGE AREA

BIOLOGICAL SURVEY
JAMES RIVER & TRIBUTARIES
(CLEARWATER PARK – NORWOOD, VA.)

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
MIDDLE ATLANTIC REGION CHARLOTTESVILLE, VA.

Fish and Wildlife and Recreation Resources

Page 7, paragraph 3. Add the following to the last sentence of this paragraph -- . . . since stream modification following Hurricane Camille has destroyed most of the trout habitat.

Water and Related Land Resource Problems

Page 8, paragraph 2. We believe the SCS definition of a "flood" should be included here as USGS records do not verify 145 floods on the Buffalo River since 1940.

Planned Project

Page 11. This section should be expanded to indicate what measures are planned as part of the land treatment measures. More information on the wildlife habitat management plan should be given.

Structural Measures

This section should also be expanded to give specific information and operating program for each dam. No mention is made of the installation of fish weirs above the impoundments to prevent the upstream movement of centrarchid fishes into trout waters. This should be included here if it is part of the project plan.

Page 12, paragraph 3. State the number and species of fish to be stocked and what plans have been incorporated for their management. Add to sentence 2 the words, "for a set fee."

Page 13, paragraph 4. We believe that the contention in sentence 4 that intrusion into the flood plain will result in an improved environment needs some added support. While improvements may be beneficial to agricultural interests, these same beneficial effects do not necessarily extend to wildlife resources and some qualification appears warranted.

Cultural Resources

An interdisciplinary investigation of the affected area should be undertaken by professional archeologists and others competent to locate and evaluate cultural resources. The results of the investigation should provide information for discussion in all relevant portions of the environmental statement. Particular attention should be paid to resources discovered during the survey that meet the criteria for nomination to the National Register. All efforts that will

be made to eliminate or mitigate adverse effects should be described.

We suggest also that the environmental statement discuss the applicability of the Reservoir Salvage Act of 1960 (80 Stat. 220) to this project.

Environmental Impact

This section is inadequate and should be expanded. It should include but not be limited to discussions of the following:

a. Construction effects on water quality, fish habitat and wildlife populations.

b. Loss of wildlife habitat due to emplacement of the dams.

c. Loss of wildlife habitat due to project development.

d. Invasion of centrarchid fishes into upstream trout waters.

e. The replacement of a stream fishery with a warm water lake type fishery.

f. Increased sedimentation and run-off due to project-induced development.

g. The potential for increased flood damage due to storms of greater than 100-year frequency because of project-induced development in flood prone areas.

Page 13, paragraph 2. The statement that project measures will improve wildlife food and habitat is unsubstantiated. Data on the wildlife habitat improvement measures should be included.

Page 14, paragraph 2. It is stated that the sediment load downstream will be reduced by 22,000 tons annually. However, no data are given of the expected increases in sedimentation due to construction, increased cultivation, and residential and industrial development. It has already been pointed out in the statement that erosion rates on cropland are 13 tons per acre per year greater than the watershed average. Thus, the erosion due to increased cultivation in the flood plain below the impoundment structures will contribute substantially to the sediment load in the James River Basin. This information should be included.

Page 14, paragraph 5. This paragraph notes the planned wildlife habitat improvement but fails to consider the expected habitat loss due to project development.

Page 14, paragraph 6. It is stated here that 5 miles of stream fish habitat will be inundated by the four lakes. No mention is made of the changes in fish species composition that will occur as a result or of the upstream invasion of centrarchid fishes into the trout waters above the reservoirs.

Page 15, paragraph 2. This paragraph should mention that the flood hazard from unusual and unexpected floods might actually increase because of project development in the flood plain. The project provides for the 100-year flood but fails to consider the impact of floods in excess of this. Hurricane Camille in 1969 and Hurricane Agnes in 1972 illustrate this point.

The proposed development will not have a significant impact on the geology of the study area. Further, from a hydrology standpoint, the statement provides an adequate discussion as to the project's impact on water and related land resources.

Favorable Effects

The effects in this section should be reconsidered in light of our previous comments.

Unavoidable Adverse Effects

The impacts in this section should also give recognition to the comments raised in our letter.

Alternatives

We believe this section of the statement does not clearly identify and describe the alternative solutions in any detail. The depth of the impact analysis is rather superficial and appears to provide a somewhat biased presentation in favor of the recommended plan. To illustrate our concern on the lack of specificity, we note the first alternative states that land treatment measures will be accelerated and no definitive information as to the scope of the measures planned. Their location and what these measures are should be discussed in some reasonable detail. This same vagueness persists throughout this subsection to the disadvantage of all reviewers. We also believe a more indepth assessment of both beneficial and adverse effects should be set forth for each solution.

As now written, the impact identification is extremely brief and somewhat biased in favor of the recommended plan. For example, what appears to be the no action alternative discusses the benefits foregone by not building the recommended plan but does not address any of the beneficial effects that could arise by retaining the present environmental setting. Fish, wildlife, esthetics and possibly water quality control may be in an improved position without the recommended plan and, if found to be true, these effects should also be identified. A more detailed discussion of these alternatives is warranted to avoid the bias that now appears to exist in this section.

Flood plain zoning, flood proofing, evacuation and flood warning systems should also be discussed in this section of the statement. In fact, zoning would appear to be a very desirable increment of the recommended plan since it would aid in reducing future flood damage and flood control investments which could be required because of project induced developments.

Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

This section should be revised to compare the relative values of the short-term use (with the project installed) with the long-term productivity of natural ecosystems without the project.

Coordination

The statement declares that no known historic or archeological sites will be affected by the project, and that the Virginia State Historic Preservation Liaison Officer and State Archeologist were consulted and will be kept informed if any such values are discovered during construction. We applaud this concern for cultural resources, but we must point out that this does not constitute evidence of interdisciplinary investigation of this integral portion of the environment, nor does it evidence compliance with the requirements of the National Historic Preservation Act of 1960 (80 Stat. 915) or Executive Order 11593 (May 13, 1971). While no known sites may exist in the area, nonetheless cultural resources may in fact exist, and project impacts upon them will remain unknown without proper investigation.

As early as possible in the planning process it should be determined whether any properties listed or eligible for listing in the National Register of Historic Places (published annually and updated monthly in the "Federal Register") will be affected by the project. If such effects will occur, the statement should indicate evidence of compliance with Section 106 of the National Historic Preservation Act according to the procedures published in the "Federal Register" of February 28, 1973.

We trust the foregoing comments will be of assistance to you in the processing of this work plan to the Congress.

Sincerely yours,

Acting
Deputy Assistant Secretary of the Interior

Mr. Kenneth E. Grant
Administrator
Soil Conservation Service
U.S. Department of Agriculture
Washington, D. C. 20250

DEPARTMENT OF THE ARMY
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C. 20310

29 JUN 1973

Honorable Robert W. Long
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Mr. Long:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Administrator of the Soil Conservation Service, by letter of 26 February 1973, requested the views of the Secretary of the Army on the work plan for Buffalo River Watershed, Virginia.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned. Specific comments on the work plan and environmental statement are inclosed for your consideration.

Sincerely,

for Kenneth E. BeLieu
Under Secretary of the Army

1 Incl
As stated

COMMENTS ON WATERSHED WORK PLAN
BUFFALO RIVER, VIRGINIA

1. Comments on the Watershed Work Plan, dated April 1972, and Environmental Impact Statement, dated February 1973, for the Buffalo River Watershed, Amherst County, Virginia, are contained in paragraphs which follow.

2. Watershed Work Plan. The dams included in the work plan appear to be adequate from a safety viewpoint. Sedimentation capacities of the reservoirs are adequate and principal spillway capacities are large enough to empty the flood retarding space in six days or less.

3. Maximum spillway velocities are 9 feet per second or less in the emergency spillway hydrograph. No information is available on the type of material at the site or the extent of erosion which might take place.

4. One of the projects being considered in the comprehensive study of the James River Basin is a dam on the Tye River below the mouth of the Buffalo River which might be as high as elevation 540. This would not effect any of the proposed structures but would flood a small portion of the reach of stream which is indicated as being benefited by the plan.

Norfolk District, Corps of Engineers
Norfolk, Virginia 23510
9 May 1973

which the project represents only a portion. It is possible, depending on distribution of rainfall, that flooding can be less, the same, or as great within the project limits as at Piedmont. Whatever assumptions are made should also be stated.

2. Environmental Impact

"Planned conservation land treatment measures will reduce erosion by approximately 14 percent, to approximately 6 tons per acre." This would be more meaningful if a time frame were given.

"The frequency of beginning damage to flood plain improvements will be reduced from about the two-year frequency to once in 5 years." It would be of benefit if "beginning damage" was defined.

4. Adverse Environmental Effects Which Cannot be Avoided

The expected damages are stated, but this section must include a discussion on the effects of these damages. For example, the effect of overcrowding pressures on zoological elements in areas to remain unflooded when they are encroached upon by those displaced from flooded areas.

9. List of Appendixes

Appendix C - Project Map - The map should be retitled to indicate that this is a portion, not the entirety, of the Buffalo River watershed. (See first comment.)

Norfolk District, Corps of Engineers
Norfolk, Virginia 23510
9 May 1973

COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT
BUFFALO RIVER WATERSHED, AMHERST COUNTY, VIRGINIA

The subject statement has been reviewed and is considered satisfactory. The following comments are included for your consideration.

1. Description

Environmental Setting:

Physical Data - It should be more clearly stated that the entire Buffalo River watershed is not included in this project, but only that portion above the Southern Railway System tracks. The complete watershed includes all land draining into the Buffalo River, which terminates at its junction with the Piney River where the Tye River is formed (7.6 miles upstream of the James).

Economic Data - It is assumed that population datum is approximated from 1970 census figures, but the source and year should be indicated.

Fish and Wildlife and Recreation Resources - In referring to faunal populations it would be helpful if subjective adjectives such as moderate, good, and fair were defined.

This section should more adequately describe the biota that are dependent on the existing river and tributary conditions during part or all of their life cycles. For example, smallmouth bass are associated with free-flowing-streams and rivers. Impoundment will create conditions in which they will cease to exist, and which are favorable to population by largemouth bass.

Water and Related Land Resource Problems:

It is stated that on the basis of stream gauge records ". . . 145 floods have occurred on Buffalo River since the gauging station was established in 1940." It should be added that the station is located at Piedmont, Virginia, which is eight miles downstream of Southern Railway System tracks (the downstream limit of project area). Water flowing at the gauging station is from the entire Buffalo River watershed (except for Taylors Creek and two intermittant creeks) of

Appendix C

Commonwealth of Virginia

STATE WATER CONTROL BOARD

P. O. Box 11143, 4010 W. Broad St., Richmond, Virginia 23230 - (703) 770-2241

June 7, 1973

Mr. John Abernathy
U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia 23240

Dear Mr. Abernathy:

Concerning your recent request for information on water quality of streams in the USDA SCS Buffalo River Watershed Project area in Amherst County, a summary of SWCB monitoring data from the period March 1970 to 30 December 1972 is enclosed.

The water quality of Buffalo River is indicated to be excellent, water degradation upstream of the proposed impoundments is not anticipated, and streambed scour below them is not expected to be harmful to existing aquatic biota or otherwise. Water quality in the proposed reservoirs proper, while not predictable with certainty, is expected on the basis of existing stream-discharge and nutrient-concentration data to remain satisfactory.

We have examined your Environmental Impact Statement dated February 1973 on the aforesaid project, and the EPA comments thereon (9 May 1973 letter from Region III's R. J. Blanco to K. E. Grant). Reviewer's reference to the Piney River is puzzling in that the Piney, though like the Buffalo a first-order tributary of Tye River, drains a different subbasin and has no apparent relevance to the Buffalo project. In particular, any bottom deposits in the Piney or in the Tye above Buffalo's confluence therewith, remaining from mining or other industrial operations at Piney River town, will not be affected by Buffalo River Watershed Project. Any such deposits in the Tye below Buffalo's confluence can only be beneficially stabilized against further migration, if affected at all, as a result of the project's leveling of Buffalo River discharge.

If we can help further, please advise.

Very truly yours,

R. L. Hill

R. L. Hill
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MEMORANDUM

State Water Control Board

4010 WEST BROAD STREET P. O. Box 11143 RICHMOND, VA. 232

SUBJECT: Buffalo River Water Quality - Virginia State Water Control Board Data (in reference to Buffalo River Watershed Project)

TO: U.S.D.A. Soil Conservation Service, Richmond. Attn. Mr. John Abernathy

FROM: R. L. Hill, Bureau of Enforcement

DATE: June 7, 1973

COPIES:

This is a summary report, made in reference to the proposed Buffalo River Watershed Project in Amherst County, of recent (1970-72) State Water Control Board water quality data for Buffalo River, a tributary of the Tye and thereby of the James. Individual analyses are not presented but are available as manuscript tabulation from the writer's files, on request.

The report presents the scope of coverage in sampling and analysis, a summary of findings, and a tabulation of extreme values (maxima and minima). One can conclude that Buffalo River water quality is very good.

A. Scope

1. Buffalo River only, Stations BUF-2.10 and BUF-23.21; numbers denote river miles above mouth of Buffalo, i.e., above its confluence with Tye River. (A station at BUF 13.53 about 1.5 mi. NE of town of Amherst was added to the State Water Control Board stream surveillance network in 1973.)

2. Time period - March 1970-December 1972: monitoring data from computerized file. (For the period mid-1968 to February 1970, this file contains nothing on Buffalo River.)

3. Sampling: once monthly with but few omissions during the period. Usually at mid-depth and center of stream.

4. Analysis schedule: variable between months. Same for both stations in any given month, with very rare exceptions.

Detail of coverage by month and analyses performed is shown on Table I.

B. Summary of Findings

On USDA SCS color "Project Map - Buffalo River Watershed," dated June 1971 and available as the last page of the April 1972 "Work Plan" document, SWCB Station BUF-23.21 is at Route 778 bridge over the river, between the two magenta G's on the map. It thus receives drainage from the area to be controlled by proposed structures 1B, 2, and 3, but not 4. Station BUF-13.53 (no data herein) is at Route 29 bridge

over the river, at the SE corner of the map, well downstream of proposed Structure 4. Station BUF-2.10 (Route 657 bridge) lies outside the mapped area to the SE.

Sampling coverage was most thorough for the parameters pH, DO, and fecal coliforms. The first two present no water quality problem at all. Minimum observed pH was 5.7, and this a low-accuracy field value. Values <6.5 were but very seldom encountered, and the water is usually neutral or slightly alkaline (pH ≥ 7.0). DO was always >7.5 mg/1, well above the highest Virginia standard.

Fecal coliforms were high in the warm months of 1970 but have improved since, although occasional high values still occur. During 1972, but not 1970-71, the downstream station was consistently the worse, presumably due to the Amherst STP.

Heavy metals (Cr, Zn, Pb, Cu, occasionally Mn, Cd, Hg, As, Fe) were sought in 1970 and 1971. All were very low. Indeed, Cr, Pb and Hg were but rarely detected; As and Cd, never.

Pesticides (chlorinated and thiophosphate) were sought only in spring and mid-summer 1971 and were below the analytical detection limit (0.10 mg/1) in all cases. However, the analytical method used was not sensitive enough to be really definitive and would reveal gross contamination only.

Nutrients were sought in spring and mid-summer 1970 and in the final two months of 1972. Moderately high values (of TKN, NO_3, ortho-P and total P in 1970, TKN and NO_3 in 1972) were occasionally seen at both stations. The effect is thus not attributable to Amherst STP alone (probably not at all), but presumably to agricultural runoff. The problem is not severe.

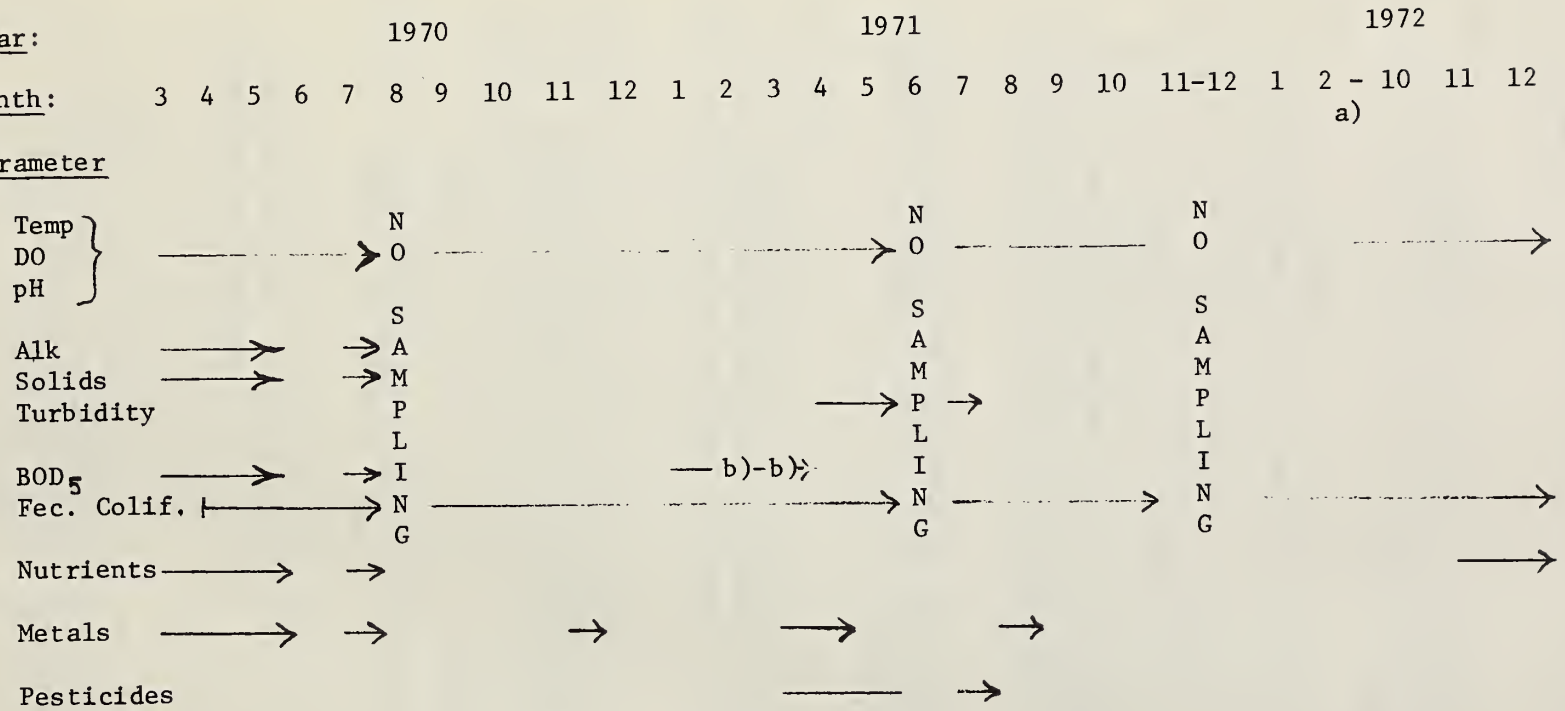
Solids and turbidity data are too scanty to be definitive. BOD_5 data, barely more extensive, are incapable of revealing current conditions.

The extreme values for single observations, and applicable State standards (Class IIIA, Public Water Supply), are shown in Table 2. The minima can usually be regarded as undisturbed normal natural background; maxima as due to disturbance, often by man but sometimes by nature.

Table 3 expands on the fecal coliform data and reflects satisfactory stream condition in this respect, especially in 1972, the last year presented. At the uppermost station, mile 23.2, only 2 of 12 analyses exceeded a MF count of 200/ml during 1972; the log mean $_{12}$ is 207 and the arithmetic average is 750, both well below the applicable Class IIIA State Water Control Board standard.

RLH/ap

TABLE 1. Water Analysis Coverage of Buffalo River by Category and Month, March 1970 - December 1972.



a) in May 1972 and August 1972, sampling occurred on final day of preceding month.

b) at downstream station only.

Appendi

TABLE 2. Extreme Observations - Buffalo River Waters

Parameter	Unit	N	Maximum Obs'n	Minimum Obs'n	Applic. Standard
pH	pH	60 field, 10 lab	a)	5.7 field, 6.4 lab	6.0 - 8.5
D.O.	mg/l (ppm)	60	14.0 (33°F)	7.6	5.0
Alkalinity	" as $CaCO_3$	8	40.	10.	30 - 500
Total solids, total	"	"	477.	89.	none
" " volatile	"	"	108.	12.	"
" " fixed	"	"	369.	51.	"
Susp. " total	"	"	176.	16.	"
" " volatile	"	"	64.	3.	"
" " fixed	"	"	112.	3.	"
Turbidity, Hellige	-	6	4.	1.0	"
BOD_5	mg/l	14	6.6	1.0	(~6)
Fec. coliforms	#/100ml MF	58	11,000+	< 100.	b)
Nutrients					
TKN	mgN/1	12	0.80	0.10	(.5,1, or
NH_3	"	"	.30	< .01	2 total N)
NO_2	"	"	.05	< .01	10 sum
NO_3	"	"	.70	.07	
o-PO_4	mg P/1	"	.17	.01	--
TP	"	"	.40	< .1	(.1 or .2)
Pesticides					
chlorinated	mg/1	8	< .10		b)
thiophosphate	"	"	< .10		0.1
Metals					
Cr	"	14	.02	< .01	none
Zn	"	"	.07	" "	"
Pb	"	10	.05	" "	.05
Cu	"	12	.03	" "	1.0
Cd	"	6	←	" "	.01
Hg	"	10	.0012	< .0005	none
As	"	6	←	< .005	.05
Mn	"	"	.08	.02	.05 c)
Fe	"	"	14.3	.10	.3 c)

Notation: N is # of samples (= # of obs'ns) totaled over both stations. "Applic. Std" is SWCB Class IIIA public water supply. If parenthesized, no such std. exists for subject waters, and value cited represents approximate current authoritative opinion.

<x signifies not detected at anal. detection limit = x.

a) Max. values 8.7, 8.3, 8.2 (all field), none others > 8.0.
b) too complex to cite.
c) filterable (dissolved) portion only.

TABLE 3. Fecal Coliform Frequencies, Buffalo River

Range Category, MF Count	Frequency						
Year:	1970		1971		1972		Row Total
	Abs.	%	Abs.	%	Abs.	%	Abs.
≥ 11,000	6	38⁻	0	0	0	0	6
4,000 - 11,000⁻	2	12⁺	2	11	3	12⁺	7
1,000 - 4,000⁻	4	25	4	22	3	12⁺	11
201 - 999	2	12⁺	3	17	1	4	6
≤ 200	2	12⁺	9	50	17	71	28
Column Total	16	100	18	100	24	100	58

Appendix C

MEMORANDUM

State Water Control Board

Appendix C

4010 WEST BROAD STREET P. O. Box 11143 RICHMOND, VA. 23230

SUBJECT: Buffalo River Water Quality - Virginia State Water Control Board Temperature Data (in reference to Buffalo River Watershed Project).

TO: USDA Soil Conservation Service, P. O. Box 10026, Richmond, Va. 23240
Attn: Mr. John Abernathy, Mr. C. M. Jones

FROM: R. L. Hill, Bureau of Enforcement RLH

DATE: August 7, 1973

COPIES: Mr. J. L. Hamrick, Buffalo River Watershed file

This correspondence, an addendum to our 7 June'73 memo to SCS (attn: Mr. Abernathy), presents temperature data for Buffalo River (usually at mid-depth and stream center) at State Water Control Board monitoring stations BUF-2.10 and BUF-23.21 for the time period March 1970 - December 1972 inclusive. Degrees F. are tabulated.

Year		1970		1971		1972	
Station		2.10	23.21	2.10	23.21	2.10	23.21
Month	J	(no data)		32	33	38	42
	F	(no data)		36	38	44	48
	M	43	39	42	45	44	43
	A	59	57	64	63	66	58
	M	57	55	63	64	58 a)	58 a)
	J	72	72	(no data)		75	80
	J	63	68	75	73	79	83
	A	(no data)		75	74	66 a)	66 a)
	S	68	76	72	72	70	70
	O	57	58	62	64	59	58
	N	40	38	(no data)		50	53
	D	41	44	(no data)		53	58

a) taken last day of preceding month

RLH/dd

Erosion[1/]

Sheet, gully, wind, stream, and road bank erosion and flood plain scour all occur in the James River Basin. Soil loss has resulted in reduced crop production, monetary value of productive land, wildlife harvest, recreational activity, and increased cost of road maintenance and construction. Probable soil loss[1/] is estimated at 2.4 tons per acre. Present erosion damages are estimated at 5.7 million dollars annually.[1/]

Sheet erosion and minor gullying on upland cropland is a serious problem in all provinces except the Coastal Plain. Scattered areas of critical sheet and gully erosion are located primarily in the Piedmont. The problem of streambank erosion is relatively minor and the cost of corrective measures far exceed the direct economic benefit.[2/] Erosion in road cuts, particularly in micaceous soil, is a serious problem. Some scouring of flood plains exists but does not appreciably affect the use or productivity.

Erosion rates are within tolerable limits for pasture and forest land use. Acreage used for row crops will steadily decline, but inadequate conservation treatment on the remainder will continue to be a problem.

Erosion rates on land used for urban development average 16.39 tons per acre annually (Table IV-2) and exceed 100 tons on some sites. Urban area development is taking place at the rate of 6,000 acres annually. Control of sediment and erosion in construction areas is a major problem in the Basin despite the relatively small areas involved.

1/ Erosion and Sedimentation, USDA, North Atlantic Regional Water Resources Study, December 1968.

2/ Streambank Erosion Study, Middle Atlantic Region, U.S. Army Corps of Engineers, 1969.

Table IV-2. Probably soil loss in tons per acre per year by subarea and land use, James River Basin

Land Use	Physiographic Province 1/			James River Basin Weighted Average 2/
	Ridges and Valleys	Blue Ridge and Piedmont	Coastal Plain	
Cropland				
Inadequately Treated	8.4	11.29	3.83	8.91
Adequately Treated	4.2	5.64	1.92	4.56
Pasture	1.7	1.69	0.85	1.66
Forest	1.2	0.60	0.28	0.66
Urban	24.8	26.74	5.78	16.39
Other	5.6	6.18	11.2	7.35
Weighted Average	2.48	3.19	1.57	2.39

1/ For identification of physiographic provinces, see Figure 5.
2/ North Atlantic Regional Water Resource Study.

Source: North Atlantic Regional Water Resource Study.

The total annual soil loss of about 15 million tons occurs primarily on the 60.9 percent of the lands on which sheet and gully erosion is the dominant conservation hazard (Table II-3). The pattern of soil loss shown in Table IV-3 is based on the assumption that the soil losses occurred on land capability subclass "e" soils; acreage for subclass "e" soils were multiplied by the soil loss rates in Table IV-2 and reduced to percent by subarea and land use. About 74.5 percent of the annual soil loss occurs in the Piedmont-Blue Ridge subarea which comprises 54.0 percent of the Basin (Table II-1). About 30.7 percent of the annual soil loss occurs on inadequately treated cropland which comprises only 7.5 percent of the land area. Uncontrolled erosion in construction areas contributes significantly to the 30.8 percent of the annual soil loss which occurs in urban areas. Table IV-4 shows this data as estimated in tons per year and indicates that annual gross erosion equals about 10.7 million tons in these land use categories. Erosion of roadsides, streambanks, and other miscellaneous areas adds about 4.3 million tons of sediment.

The gross erosion rates for both present and accelerated land treatment levels are shown in Table IV-5. The leveling off of the rate of erosion between 1980 and 2000 reflects the increased acreage of cropland undergoing treatment. The increase in the rate of erosion after 2000 is due to urban expansion. The erosion rate is highest in the Piedmont and Blue Ridge and lowest in the Coastal Plain. Flatter gradients and greater abundance of pervious

Table IV-3. Pattern of soil loss[1/] by subarea and land use, 1968, James River Basin

Land Use	Physiographic Province: Ridges and Valleys	Blue Ridge and Piedmont	Coastal Plain	Total
	Percent			
Cropland				
Inadequately Treated	4.4	25.1	1.2	30.7
Adequately Treated	1.8	5.9	.4	8.1
Pasture	2.4	4.7	.1	7.2
Forest	5.8	10.0	.7	16.5
Other	1.1	4.1	1.5	6.7
Urban	2.9	24.7	3.2	30.8
Total	18.4	74.5	7.1	100.00

1/ Based on the assumption that the soil loss occurred from land capability subclass "e" soils as presented in the 1967 Conservation Needs Inventory and gross annual soil loss rates shown in Table IV-2. Urban areas were estimated to occupy subclass "e" soils in the same proportion as farm and forest land in each subarea.

Table IV-4. Annual erosion distribution by subarea and use, 1967[1/], James River Basin

Land Use	Ridges and Valleys	Blue Ridge and Piedmont	Coastal Plain	Total
	Tons per year			
Cropland				
Adequately Treated	191,268	629,334	42,902	863,504
Inadequately Treated	467,544	2,677,040	123,154	3,267,738
Pasture	258,400	501,211	10,030	769,641
Forest	619,800	1,072,320	71,988	1,764,108
Other	116,480	443,724	160,160	720,364
Urban	311,835	2,633,168	346,424	3,291,427
Total	1,965,327	7,956,797	754,658	10,676,782[2/]

1/ Based on 1967 CNI use shown for land capability subclass "e" soils and gross annual erosion rates in Table IV-5. Urban areas were estimated to occupy subclass "e" soils in same proportion as farm and forest land in each subarea.

2/ Erosion on land capability subclass "s" and "w", streambanks, roadsides, and other miscellaneous areas would add about 4.3 million tons to this total.

Table IV-5. James River Basin projected gross erosion rates by subarea, annual soil loss in tons/acre/year, James River Basin

Physiographic Province	Level of Land Treatment 1/					
	Present			Accelerated		
	1980	2000	2020	1980	2000	2020
Ridges and Valleys	2.58	2.69	3.26	2.51	2.55	3.13
Blue Ridge and Piedmont	3.40	3.66	4.71	3.31	3.47	4.51
Coastal Plain	1.88	1.80	2.35	1.82	1.73	2.26
Basin Average	2.61	2.65	3.37	2.53	2.49	3.22

1/ Under present and accelerated levels of conservation treatment.

sands and gravels cause the lower rates in the Coastal Plain. The intermediate position of the Ridges and Valleys is due to greater slope and areas of rock outcrop.

Sediment 1/

Erosion in the James River Basin produces about 1.2 million tons of sediment annually. The sediment delivery ratio averages about 7.5 percent of the gross erosion rates discussed above. The pattern of the sediment source by land use and subarea would approximate that shown for annual soil loss in Table IV-3. Sediment is an especially acute problem in and immediately below construction areas. These relatively limited areas cause a disparate amount of the sediment damages.

Sediment damage to flood plain land and improvements, water supply reservoirs and other impoundments are estimated at 3 million dollars annually.[1] Assuming continuation of the present level of land treatment, sedimentation rates will increase from 115 tons per square mile per year to 162 tons per square mile per year in 2020 (Table IV-6). Present and projected sedimentation rates by subarea are shown in Table IV-7. As in the case of erosion, the leveling off or decrease in sedimentation rate between 1980 and 2000 reflects the influence of more cropland under treatment measures. The increase in erosion after 2000 is due to urbanization.

1/ Erosion and Sedimentation, USDA, North Atlantic Regional Water Resources Study, December 1968.

Table IV-6. Rate of sediment yield in tons per square mile per year for varied size drainage areas, James River Basin

Drainage Area Sq. Miles	Year 1968	1980	2000	2020
1	444	484	492	626
10	275	301	305	388
100	145	159	161	205
1,000	63	68	70	88
Basin Average	115	125	127	162

Source: Erosion and Sedimentation, USDA, North Atlantic Regional Water Resources Study, December 1968.

Table IV-7. Rate of sediment yield in tons per acre/year by subarea, James River Basin

Physiographic Province	Level of Land Treatment 1/ Present 1968	1980	2000	2020	Accelerated 1968	2000	2020
Ridges and Valleys	.186	.193	.202	.24	.188	.191	.235
Blue Ridge & Piedmont	.239	.255	.274	.35	.248	.260	.338
Coastal Plain	.118	.141	.135	.17	.136	.130	.170

Approximately 213,200 acres of upstream flood plain land are subject to sediment damages. Sediment deposits as a result of the floods and landslides during Hurricane Camille in 1969 clogged channels and damaged flood plain lands. As a partial measure of damages caused by this storm, an estimated four million dollars in emergency funds were required for channel restoration to prevent immediate recurrence of floods.

CHAPTER V

PRESENT AND FUTURE NEEDS FOR WATER AND RELATED LAND RESOURCES

The problems identified and described in Chapter IV are translated into current and projected needs in this chapter. This is accomplished within the framework of the natural resources described in Chapter II and the related socioeconomic situation described in Chapter III. Therefore, in this chapter we discuss topics similar to those found in Chapter IV, but our discussion concentrates on the needs of the Basin as related to the problems being experienced.

Institutional and Environmental

An essential need related to resource development in the Basin is the reversal of traditional attitudes which have resulted in the degradation of man's environment. Recent legislation and directives require that environmental considerations be one of the principal criteria in the administration of Federal programs. Similar regulatory laws and ordinances are needed at State and local levels to encourage voluntary adherence to principles which benefit property owners as well as the general public. A secondary purpose would allow legal restraints when needed to protect the general public from the results of individual actions.

As implied above, greater emphasis is needed in all resource programs to assure that land is used according to its capability and treated according to its needs for conservation and sustained production of the needs and amenities of life. All resources must be used first to provide the material necessities of society, but they should be used and managed insofar as practical to enhance esthetic, healthful and other environmental values.

Planners and developers of urban areas have a particular need for application of tools and techniques such as those developed under USDA programs. The agricultural sector needs to continue use of the land use capability system to assist farm owners and operators for such purposes as selection of the least erodible soils for cultivated crops. This soil classification system can provide vital information for selection of waste disposal sites, zoning, and other needs of land use planners in urban areas. Advisory services need to be expanded to aid local governing bodies in preparing regulations for control of erosion in construction areas, flood plain management, and related purposes. Technical information and guidance services need to be utilized to a greater extent as a basis for decisions affecting wetlands, unique scenic areas, and other esthetic and recreational resources.

Watershed Protection and Management

Problems discussed in the previous chapter indicate a need for an accelerated land treatment program or conversion of land to more desirable uses. The 1967 Conservation Needs Inventory shows that 36 percent of the cropland, 28 percent of the pasture, and 68 percent of the forest land is adequately treated. This leaves approximately 2.4 million acres needing additional land treatment measures (Table V-1).

Table V-1. Land treatment needs, James River Basin

Land Use	Total	Adequately treated	Needing Treatment
		1,000 acres	
Cropland	736.2	268.0	468.2
Pasture	655.9	182.1	473.8
Non-Federal Forest Land	3,649.3	2,229.0	1,420.3
Federal Forest Land	754.2	749.2	5.0
Total	5,795.6	3,428.3	2,367.3

Cropland

Land treatment measures needed on cropland to maintain productivity and limit erosion include the use of conservation cropping systems consisting of stripcropping, cover and green manure crops, and the growing of grasses and legumes in rotation using minimum tillage. The removal of excess runoff and seep water from uplands can be accomplished by the installation of tile drains, open ditch drains, and the use of grassed waterways and terraces in connection with contour farming. Table V-2 shows that improved treatment and management is needed on about 64 percent of the cropland.

Table V-2. Cropland treatment needs, James River Basin

Physiographic Province	Total	Adequately Treated	Needing Treatment
		1,000 acres	
Ridges and Valleys	142.2	64.0	78.2
Piedmont-Blue Ridge	439.2	140.5	298.7
Coastal Plain	154.8	63.5	91.3
Total	736.2	268.0	468.2

Pasture

The reduction of erosion and sediment yields on grasslands can be accomplished by such practices as pasture and hayland renovation and management, the use of improved varieties of seeds, brush and weed control, lime, fertilizer, and controlled grazing. The use of herbicides and fertilizers to improve pasture conditions should not overlook the effect which the use of these methods can cause on water quality. The development of springs and seeps and the construction of troughs, tanks, and farm ponds will provide greater latitude in the use of pastures to help to reduce overgrazing. These practices will improve soil cover conditions and increase carrying capacities and net income from livestock farming (Table V-3).

Table V-3. Pasture treatment needs, James River Basin

Physiographic Province	Total	Adequately Treated	Needing Treatment
	1,000 acres		
Ridges and Valleys	254.0	58.4	195.6
Piedmont-Blue Ridge	377.6	117.1	260.5
Coastal Plain	24.3	6.6	17.7
Total	655.9	182.1	473.8

Forest Land

Effective watershed protection and management of forest land are carried out jointly. The impact of applying forest management techniques results in the need to apply watershed protection measures. The intensity of application of these measures will vary with the severity of impact and the hazards of erosion forces. The soil characteristics, the length of slope, and forest cover conditions are closely related. The nature of forest cover provides for any site an opportunity to maximize, by vegetative treatment, the control of runoff from flood producing rainfalls. However, the forest cannot prevent floods. Interception, infiltration, and soil moisture storage are the principal ways in which forest cover diminishes the peak discharges from flood producing storms. Forests, by preventing erosion and sedimentation, help to maintain stream channel capacity in order that storm flow can be carried with a minimum of flooding. The maintenance of well stocked stands of both pine and hardwood are vital to practicing good waterhsed management, especially on the steeper slopes.

Forestry practices need to be employed to bring present forest stands up to their level of capacity to produce wood products, improve hydrologic conditions, and develop wildlife habitat to benefit designated game species. These practices include site preparation, regeneration, timber stand improvement, harvesting techniques, and planting. The application of these practices will vary among landowners to reflect the diverse attitudes for managing the total resources of the forest ecosystem.

Forty percent of the forest land in both the Coastal Plain and Piedmont-Blue Ridge areas and 18 percent in the Ridges and Valleys area needs treatment (Table V-4).

Table V-4. Forest land treatment needs[1/], James River Basin

Physiographic Province	Total	Adequately Treated	Needing Treatment
	1,000 acres		
Ridges and Valleys	1,475.1	1,216.0	259.1
Piedmont-Blue Ridge	2,397.7	1,443.8	953.9
Coastal Plain	530.7	318.4	212.3
Total	4,403.5	2,978.2	1,425.3

1/ Includes 795,400 acres of Federal forest land; George Washington N. F., 536,200 acres; Jefferson N. F., 218,000 acres; National Park Service, 41,200 acres which will receive no cultural treatment.

Forest land restoration needs include gully stabilization, sheet erosion control, streambank stabilization, road and travel stabilization, mine area stabilization, and stream channel clearing. Approximately 5,000 acres in erosion control at an estimated cost of $1,640,200 is recommended on both National forests (Table VIII-13 and VIII-14). Approximately 12,200 acres of abandoned road and travel stabilization at an estimated cost of $2,440,000 is recommended on private forest land.

Critical Erosion Areas

Only one-half of one percent of the James River Basin is considered to be critical in terms of needing land treatment measures. Although only a small portion of the Basin, this 33,000 acres represents a disparate percentage of the annual erosion and sediment damages.

Presently land is being developed at an annual rate of 6,000 acres for residential, commercial, and industrial purposes. Carefully prepared plans with provision for temporary vegetative cover and structural measures during construction will reduce the magnitude of the erosion and sediment problems associated with such development. This not only will result in a savings to the developer and the community, but will create a more desirable environment in the immediate area and further downstream.

Another 15,000 acres of critical areas involves secondary, primary, and interstate highway system. Proper sloping and vegetating roadbanks during construction will reduce this problem and also improve the scenic qualities of highways. The installation of temporary land treatment and structural measures during construction will further reduce quantities of sediment being deposited in our streams, harbors, ponds, and lakes. Developers often create sediment problems in streams and ponds below construction projects, resulting in losses to the private individual.

Approximately 11,000 acres of agricultural land are considered critical sediment producing areas. These areas are primarily in cropland and overgrazed pasture on soils in land capability classes VI-e and VII-e. Better treatment or less intensive use is needed to reduce erosion and sediment production.

About 1,000 acres of active and abandoned mining operations need grading, shaping, and establishment of permanent vegetation.

Flood Prevention

The extent and amount of floodwater damages in upstream watersheds are summarized in Table V-5 by subareas. About 64 percent of the flood prone areas are in the Blue Ridge-Piedmont subarea, 30 percent in the Ridges and Valleys, and 6 percent in the Coastal Plain. The Ridges and Valleys suffer 60.3 percent of the economic losses because of the concentration of developments on the narrow valleys of the subarea. Crop and pasture damages constitute the major portion of economic losses in the Blue Ridge-Piedmont subarea, which comprise 38.2 percent of the Basin total. Only 1.5 percent of these losses accrue in the Coastal Plain.

Needs for upstream flood prevention measures are greatest in the Ridges and Valleys. Roads, homes, and other developments will continue to be concentrated in flood plains which comprise most of the relatively level land in the subarea. More options are available for location of such developments in other subareas.

Improved land treatment as discussed above is the basic need and first consideration in alleviating flood problems. The next consideration is to determine to what extent flood plain management

Table V-5. Summary of extent and amount of floodwater damages in upstream watersheds, James River Basin

Subarea	Area in flood plains (Acres)	Average annual damages (dollars)
Ridges and Valleys	64,000	2,202,000
Blue Ridge-Piedmont	136,400	1,398,800
Coastal Plain	12,800	56,200
Total	213,200	3,657,000

Source: Watershed investigation reports as defined in Chapter I.

and other non-structural measures will meet flood prevention objectives. In subwatersheds where such measures will not provide practical solutions, the physical potential and economic feasibility of structures for temporary storage of floodwaters are assessed. Channel alterations, floodways, dikes, and levees are usually the last alternatives considered.

In some subwatersheds the public interest may best be served by preserving the existing environmental resources. Other watersheds may not offer the physical features to allow use of structural measures. The results of watershed investigations and specific needs suggested for flood prevention are presented in later chapters of this report.

Drainage Improvement

The 1967 Conservation Needs Inventory indicates that 159,200 acres of agricultural land need improved drainage. To date only 23,500 acres have adequate drainage measures applied, thus leaving a need for drainage improvement measures on 135,700 acres (Table V-6). The need for group drainage projects are not applicable in most cases, as the areas involved are small and can be handled through present USDA programs.

Generally, random tile systems and open ditch drains are adequate to solve drainage problems. Occasionally, there is need for some surface land leveling in the southern Piedmont and Coastal Plain.

CHAPTER 406

An Act to amend the Code of Virginia by adding in Chapter 1 of Title 21, an article numbered 6.1 containing sections numbered 21-89.1 through 21-89.15 to provide for an acceleration and extension of the program for control of soil erosion and sediment damage resulting from certain land disturbing activities within the State; to provide for adoption of a comprehensive Statewide soil erosion and sediment control program and guidelines and for adoption by soil and water conservation districts, counties, cities and towns of soil erosion and sediment control programs and guidelines and for adoption by soil and water conservation districts, counties, cities and towns of soil erosion and sediment control programs consistent with such Statewide program and guidelines; to require the filing and approval of plans for the control of soil erosion and sediment damage in connection with certain land disturbing activities; to provide for inspections and reports; to declare certain acts to be unlawful; to provide for administration and enforcement; and for other purposes.

[H 766]

Approved [illegible]

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia be amended by adding in Chapter 1 of Title 21, an article numbered 6.1 containing sections numbered 21-89.1 through 21-89.15 as follows:

Article 6.1.

Erosion and Sediment Control Law

§ 21-89.1. This article shall be known as the "Erosion and Sediment Control Law".

§ 21-89.2. The General Assembly has determined that the lands and waters comprising the watersheds of the State are great natural resources; that as a result of erosion of lands and sediment deposition in waters within the watersheds of the State, said waters are being polluted and despoiled to such a degree that fish, aquatic life, recreation and other uses of lands and waters are being adversely affected; that the rapid shift in land use from agricultural to nonagricultural uses has accelerated the processes of soil erosion and sedimentation; and further, it is necessary to establish and implement, through the Virginia Soil and Water Conservation Commission, hereinafter referred to as the "Commission", and the soil and water conservation districts, hereinafter referred to as "districts", in cooperation with counties, cities, towns, other subdivisions of this State, and other public and private entities, a Statewide coordinated erosion and sediment control program to conserve and to protect the land, water, air and other natural resources of the Commonwealth.

§ 21-89.3. Definitions. As used in this article, unless the context clearly indicates otherwise:

(a) "Land disturbing activity" shall mean any land change which may result in soil erosion from water or wind and the movement of sediments into State waters or onto lands in the State, including, but not limited to, clearing, grading, excavating, transporting and filling of land, other than federal lands, except that the term shall not include; (i) such minor land disturbing activities as home gardens and individual home landscaping, repairs and maintenance work; (ii) individual service connections and construction or installation of public utility lines; (iii) septic tank lines or drainage fields unless included in an overall plan for

land disturbing activity relating to construction of the building to be served by the septic tank system; (iv) surface or deep mining, neither shall it include tilling, planting, or harvesting of agricultural, horticultural, or forest crops; (v) construction, repair or rebuilding of the tracks, right of way, bridges, communication facilities and other related structures and facilities of a railroad company; (vi) preparation for single-family residences separately built, unless in conjunction with multiple construction in subdivision development, or individual noncommercial tracts of land of less than fifteen thousand square feet.

(b) "Person" shall mean any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town, or other political subdivision of this State, any interstate body, or any other legal entity.

(c) "Town" shall mean an incorporated town.

(d) "Conservation standards" or "standards" shall mean standards adopted by the Commission or the districts, counties, cities and towns pursuant to §§ 21-89.4 and 21-89.5, respectively, of this act.

(e) "Specifications" shall mean the written procedures, requirements or plans to control erosion and sedimentation as officially adopted by the Governing Board or Commission of a State agency or institution or by an agency's administrative head if there is no Board or Commission.

(f) "Conservation plan", "erosion and sediment control plan", or "plan", shall mean a document containing material for the conservation of soil and water resources of a unit or group of units of land. It may include appropriate maps, an appropriate soil and water plan inventory and management information with needed interpretations, and a record of decisions contributing to conservation treatment. The plan shall contain all major conservation decisions to assure that the entire unit or units of land will be so treated to achieve the conservation objectives.

(g) "State erosion and sediment control program" or "State program" shall mean the program adopted by the Commission consisting of conservation standards, guidelines and criteria to minimize erosion and sedimentation.

(h) "Local erosion and sediment control program" or "local control program" shall mean an outline or explanation of the various elements or methods employed by a district, county, city, or town to regulate land disturbing activities and thereby minimize erosion and sedimentation in compliance with the State program and may include such items as a local ordinance, policies and guidelines, technical materials, inspection, enforcement and evaluation.

(i) "Plan approving authority" shall mean the district or a county, city, or town, or a department of a county, city, or town, responsible for determining the adequacy of a conservation plan submitted for land disturbing activities on a unit or units of lands and shall approve such plan if the plan is determined to be adequate.

§ 21-89.4. State erosion and sediment control program. (a) The Commission shall establish minimum standards, guidelines and criteria for the effective control of soil erosion, sediment deposition and nonagricultural runoff which must be met in any control program. To assist in the development of the program, the Commission shall seek the advice of the State Water Control Board (the opinion of the State Water Control Board shall be advisory only) and may seek the advice of other appropriate State and federal agencies and shall name an advisory board of not less than seven nor more than eleven members which shall include but not be limited to representatives of such interests as residential development and construction, nonresidential construction, and agriculture. At

least two members of the advisory board shall be from the public at large having no direct pecuniary interest, and at least two members shall be from local governments.

(b) To implement this program, the Commission shall develop and adopt by July one, nineteen hundred seventy-four, guidelines for erosion and sediment control, which guidelines may be revised from time to time as may be necessary. In accordance with Chapter 1 of Title 9 of this Code, the Commission shall give due notice and conduct public hearings on the proposed guidelines or proposed change in existing guidelines before adopting or revising such guidelines. The guidelines for carrying out the program shall:

(1) be based upon relevant physical and developmental information concerning the watersheds and drainage basins of the State, including, but not limited to, data relating to land use, soils, hydrology, geology, size of land area being disturbed, proximate water bodies and their characteristics, transportation, and public facilities and services;

(2) include such survey of lands and waters as may be deemed appropriate by the Commission or required by any applicable law to identify areas, including multijurisdictional and watershed areas, with critical erosion and sediment problems; and

(3) contain conservation standards for various types of soils and land uses, which standards shall include criteria, techniques, and methods for the control of erosion and sediment resulting from land disturbing activities.

(c) The program and guidelines shall be made available for public inspection at the office of the Commission.

§ 21-89.5. Local erosion and sediment control programs. (a) Each district in the Commonwealth, except as provided in subsection (c) of this section, shall within eighteen months after the adoption of the State guidelines, develop and adopt a soil erosion and sediment control program consistent with the State program and guidelines for erosion and sediment control. Districts adopting such programs shall do so pursuant to the provisions of the General Administration Agencies Act. To assist in developing its program, each district shall name an advisory committee of not less than seven nor more than eleven members which shall include but not be limited to representatives of such interests as residential development and construction, nonresidential construction, and agriculture. At least two members of the advisory board shall be from the public at large having no direct pecuniary interest, and at least two members shall be from local governments. Upon the request of a district the Commission shall assist in the preparation of the district's program. Upon adoption of its program, the district shall submit the program to the Commission for review and approval.

To carry out its program the district shall, within one year after the program has been approved by the Commission, establish, consistent with the State program and guidelines, conservation standards for various types of soils and land uses, which standards shall include criteria, guidelines, techniques, and methods for the control of erosion and sediment resulting from land disturbing activities. Such conservation standards may be revised from time to time as may be necessary. Before adopting or revising conservation standards, the district shall, after giving due notice, conduct a public hearing on the proposed conservation standards or proposed changes in existing standards. The program and conservation standards shall be made available for public inspection at the principal office of the district.

(b) In areas where there is no district, a county, city, or town shall develop, adopt and carry out the erosion and sediment control program and exercise the responsibilities of a district with respect thereto,

as provided in this act; except that the provisions for an advisory committee shall not be mandatory.

(c) Any county, city, or town that, prior to July one, nineteen hundred seventy-five, has adopted its own erosion and sediment control program which has been approved by the Commission shall be treated under this act as a county, city, or town which lies in an area where there is no district, whether or not such district in fact exists.

Any town, lying within a county which adopts its own erosion and sediment control program, must adopt its own program, or adopt jointly with the county an erosion and sediment control program or authorize the county to adopt the program for the town. If a town lies within the boundaries of more than one county, such town shall be considered for the purposes of this article to be wholly within the county in which the larger portion of the town lies. Any county, city, or town adopting an erosion and sediment control program may designate its department of public works or a similar local government department as the plan approving authority or may designate the district as the plan approving authority for all or some of the conservation plans.

(d) If a district, or county, city, or town not in a district, fails to submit a program to the Commission within the period specified herein, the Commission shall, after such hearings or consultations as it deems appropriate with the various local interests involved, develop and adopt an appropriate program to be carried out by such district, county, city, or town. The Commission shall do likewise with respect to any town lying within a county which adopts its own erosion and sediment control program and such town does not provide for land disturbing activities within the town to be covered by a local control program.

§ 21-89.6. Regulated land disturbing activities. (a) Except as provided in subsections (e) and (f) of this section, no person may engage in any land disturbing activity after the adoption of the conservation standards by the districts, counties, cities or towns until he has submitted to the district, county, city, or town an erosion and sediment control plan for such land disturbing activity and such plan has been reviewed and approved by the plan approving authority. Where land disturbing activities involve lands under the jurisdiction of more than one local control program an erosion and sediment control plan may, at the option of the applicant, be submitted to the Commission for review and approval rather than submission to each jurisdiction concerned.

(b) Upon submission of an erosion and sediment control plan to a plan approving authority or to the Commission:

(1) the plan approving authority shall, within forty-five days, approve any such plan if it determines that the plan meets the conservation standards of the local control program and if the person responsible for carrying out the plan certifies that he will properly perform the erosion and sediment control measures included in the plan and will conform to the provisions of this act;

(2) the Commission shall review plans submitted to it and shall within forty-five days approve any such plan if it determines that the plan is adequate in consideration of the Commission's guidelines and the conservation standards of the local control program or programs involved, and if the person responsible for carrying out the plan certifies that he will properly perform the conservation measures included in the plan and will conform to the provisions of this act.

(c) The plan approving authority or Commission must act on all plans submitted within forty-five days from receipt thereof by either approving said plan in writing or by disapproving said plan in writing and giving the specific reasons for its disapproval. When a plan submitted for

approval under this section is found, upon review by the respective agency, to be inadequate, such agency shall specify such modifications, terms, and conditions as will permit approval of the plan and communicate these requirements to the applicant as herein required. If no action is taken by the plan approving authority or Commission within the time specified above, the plan shall be deemed approved and the person authorized to proceed with the proposed activity.

(d) An approved plan may be changed by the authority which has approved the plan or by the Commission when it has approved the plan in the following cases:

(1) where inspection has revealed the inadequacy of the plan to accomplish the erosion and sediment control objectives of the plan, and appropriate modifications to correct the deficiencies of the plan are agreed to by the plan approving authority and the person responsible for carrying out the plan; or

(2) where the person responsible for carrying out the approved plan finds that because of changed circumstances or for other reasons the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of this act, are agreed to by the plan approving authority and the person responsible for carrying out the plan.

(e) Any person owning, occupying, or operating private agricultural, horticultural or forest lands shall not be deemed to be in violation of this act for land disturbing activities resulting from the tilling, planting or harvesting of agricultural, horticultural or forest crops or products, or engineering operations under § 21-2(c) of the Code of Virginia. Such person shall comply with the provisions of this act when grading, excavating or filling.

(f) Any State agency that undertakes a project involving a land disturbing activity shall file specifications or a conservation plan with the Commission for review and written comments. The Commission shall have sixty days in which to comment and such comment shall be binding on the State agency or the private business hired by the State agency. Individual approval of separate projects is not necessary when approved specifications are followed.

The State agency shall submit changes in the conservation plan or specifications as they occur to the Commission and shall submit specifications and plans at least annually for review.

Further, the State agency responsible for the land disturbing activity shall ensure compliance with the approved plan or specifications.

(g) For the purposes of subsections (a) and (b) of this section, when land disturbing activity will be required of a contractor performing construction work pursuant to a construction contract, the preparation, submission and approval of an erosion and sediment control plan shall be the responsibility of the owner.

§ 21-89.7. Approved plan required for issuance of grading, building, or other permits. Upon the effective date of the adoption of the conservation standards by the districts, counties, cities or towns, when standards have not otherwise been adopted, no agency authorized under any other law to issue grading, building, or other permits for activities involving land disturbing activities may issue any such permits unless the applicant therefor submits with his application the approved erosion and sediment control plan or certification of such approved plan from the local plan approving authority or from the Commission where appropriate, as well as certification that such plan will be followed. Such agency, prior to issuance of any permit, may also require from any applicant a reasonable performance bond, cash escrow, letter of credit, any combination thereof, or such

other legal arrangement acceptable to the agency, to ensure that emergency measures could be taken by the county, city or town at the applicant's expense should he fail within the time specified to initiate appropriate conservation action which may be required of him as a result of his land disturbing activity. Within sixty days of the completion of the land disturbing activity, such bond, cash escrow, letter of credit or other legal arrangement, or the unexpended or unobligated portion thereof, shall be refunded to the applicant or terminated, as the case may be. These requirements are in addition to all other provisions of law relating to the issuance of such permits and are not intended to otherwise affect the requirements for such permits.

§ 21-89.8. Monitoring, reports and inspections. (a) Land disturbing activities where permit is issued. With respect to approved plans for erosion and sediment control in connection with land disturbing activities which involve the issuance of a grading, building, or other permit, either the permit issuing authority or plan approving authority shall provide for periodic inspections of the land disturbing activity to ensure compliance with the approved plan, and to determine whether the measures required in the plan are effective in controlling erosion and sediment resulting from the land disturbing activities. Notice of such right of inspection shall be included in the permit. The owner, occupier or operator shall be given an opportunity to accompany the inspectors. If the permit issuing authority or plan approving authority determines that the permittee has failed to comply with the plan, the authority shall immediately serve upon the permittee by registered or certified mail to the address specified by the permittee in his permit application a notice to comply. Where the plan approving authority serves notice, a copy of each notice shall also be sent to the issuer of the permit. Such notice shall set forth specifically the measures needed to come into compliance with such plan and shall specify the time within which such measures shall be completed. If the permittee fails to comply within the time specified, he may be subject to revocation of the permit; furthermore, he shall be deemed to be in violation of this act and upon conviction shall be subject to the penalties provided by the act.

(b) Other regulated land disturbing activities. With respect to approved plans for erosion and sediment control in connection with all other regulated land disturbing activities, the plan approving authority may require of the person responsible for carrying out the plan such monitoring and reports, and may make such on-site inspections after notice to the resident owner, occupier or operator as are deemed necessary to determine whether the soil erosion and sediment control measures required by the approved plan are being properly performed, and whether such measures are effective in controlling soil erosion and sediment resulting from the land disturbing activity. Such resident owner, occupier or operator shall be given an opportunity to accompany the inspectors. If it is determined that there is failure to comply with the approved plan, the plan approving authority shall serve notice upon the person who is responsible for carrying out the plan at the address specified by him in his certification at the time of obtaining his approved plan. Such notice shall set forth the measures needed for compliance and the time within which such measures shall be completed. Upon failure of such person to comply within the specified period, he will be deemed to be in violation of the act and upon conviction shall be subject to the penalties provided by the act.

(c) Additional provisions. Notwithstanding the above provisions of this section the following may be applied:

(1) Where a county, city, or town adopts the local control program and the permit issuing authority and the plan approving authority are

not within the same local government department, the county, city, or town may designate one department to inspect, monitor, report and insure compliance. In the event a district has been designated as the plan approving authority for all or some of the conservation plans, the enforcement of the program shall be with the local government department; however, the district may inspect, monitor and make reports for the local government department.

(2) Where a district adopts the local control program and permit issuing authorities have been established by a county, city, or town, the district by joint resolution with the applicable county, city, or town may exercise the responsibilities of the permit issuing authorities with respect to monitoring, reports, inspections and enforcement.

(3) Where a permit issuing authority has been established, and such authority is not vested in an employee or officer of local government but is the Commissioner of Revenue or some other person, the county, city, or town shall exercise the responsibilities of the permit issuing authority with respect to monitoring, reports, inspections and enforcement unless such responsibilities are transferred as provided for in the above provisions of this section.

§ 21-89.9. Cooperation with federal and State agencies. The districts, counties, cities or towns operating their own programs, and the Commission are authorized to cooperate and enter into agreements with any federal or State agency in connection with plans for erosion and sediment control with respect to land disturbing activities.

§ 21-89.10. Appeals. (a) Final decisions of counties, cities or towns under this act shall be subject to review by the court of record of the county or city, provided an appeal is filed within thirty days from the date of any written decision adversely affecting the rights, duties or privileges of the person engaging in or proposing to engage in land disturbing activities.

(b) Final decision of the districts shall be subject to an administrative review by the Commission, provided an appeal is filed within thirty days from the date of the written decision.

(c) Final decisions of the Commission either upon its own action or upon the review of the action of a district shall be subject to review by the Circuit Court of the City of Richmond, provided an appeal is filed within thirty days from the date of the written decision of the Commission.

§ 21-89.11. Penalties, injunctions and other legal actions. (a) A violation under §§ 21-89.6 or 21-89.8 of this chapter shall be deemed a misdemeanor and upon conviction shall be subject to a fine not exceeding one thousand dollars or thirty days imprisonment for each violation or both.

(b) The appropriate permit issuing authority, a district, a county, city, or town operating its own program, or the Commission may apply to the court of record in the jurisdiction wherein the land lies, or to the Circuit Court of the City of Richmond should the lands lie in more than one jurisdiction, for injunctive relief to enjoin a violation or a threatened violation under §§ 21-89.6 or 21-89.8 of this act, without the necessity of showing that there does not exist an adequate remedy at law.

(c) The Commonwealth's Attorney shall, upon request of a district, county, city, or town operating its own program, or the permit issuing authority, take legal action to enforce the provisions of this act. The State Attorney General shall, upon request of the Commission, take appropriate legal action on behalf of the Commission to enforce the provisions of this act.

(d) Compliance with the provisions of this article shall be prima

facie evidence in any legal or equitable proceeding for damages caused by erosion, siltation or sedimentation that all requirements of law have been met and the complaining party must show negligence in order to recover any damages.

§ 21-89.12. Authorization for more stringent standards. A district, county, city or town is hereby authorized to adopt more stringent soil erosion and siltation standards than those necessary to ensure compliance with the State's minimum standards, guidelines and criteria. However, nothing in this section shall be construed to authorize any district, county, city or town to impose any more stringent regulations for plan approval or permit issuance than those specified in §§ 21-89.6 and 21-89.7.

§ 21-89.13. No limitation on authority of Water Control Board or Department of Conservation and Economic Development. Nothing contained within the provisions of this chapter shall limit the powers or duties presently exercised by the State Water Control Board under Chapter 3.1 of Title 62.1 of this Code, or the powers or duties of the Department of Conservation and Economic Development as it relates to strip mine reclamation under Chapters 16 and 17 of Title 45.1 of this Code.

§ 21-89.14. Severability. If any provision of this act is held to be unconstitutional or invalid, such unconstitutionality or invalidity shall not affect the remaining provisions of this act.

§ 21-89.15. Nothing in this act shall affect any project commenced prior to the adoption of the conservation standards by the districts, counties, cities or towns.

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President of the Senate

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Speaker of the House of Delegates

Approved:

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Governor